HERAPDF3.0JETS progress to NNLO

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Updating HERAPDF2.0Jets with new H1 lowQ2 jet data AND
Going to NNLO with the jets

We have already established great agreement Mandy/Katyarzyna ie Oxford code/xFitter with all jets including the new H1 low Q2 jets at NLO..
I will not show this again today

TODAY: Now we have extended this agreement to NNLO
Thanks to Sasha Zenaiev for the xFitter NNLO implementation

We got NNLO grids for the jet data from Daniel
All that were included in HERAPDF2.0Jets
----------**except** trijets
----------**plus** the H1 2016 low q2 inclusive and dijets
Note: one also has to cut some low Q2 points and some ZEUS di-jets points to work at NNLO

We are working to Iris' plan – with a few necessary modifications- we have got as far as point 4

1) keep ALL settings as for HERAPDF2.0
throw the heavy flavour data out for the fit
--> HERAPDF2.5NLO-Jets-only
compare HERAPDF2.0Jets to HERAPDF2.5Jets-only
message: it makes no difference

2) produce the exactly same fit in NNLO --> HERAPDF2.5NNLO-Jets-only
MAJOR MESSAGE:
What does NNLO do?
How does alphas_s change?
Is the scale uncertainty less?

Cannot quite do this because some data/sets and points must be cut

3) add new jet data and produce [with everything else still as HERAPDF2.0]
HERAPDF3.0NLO-Jets-only
HERAPDF3.0NNLO-Jets-only
==> Message: what do low Q^2 jets do.

Also we answer these questions in a slightly different order

4)-- do new mass parameter scans with new HF data and produce
HERAPDF3.5NLO-Jets-only
HERAPDF3.5NNLO-Jets-only
==> message: mass parameters are insignificant at this level

5)-- add the HF data to the fit and produce
HERAPDF3.5NLO-Jets
HERAPDF3.5NNLO-Jets with full error analysis
==> message: using the HF data explicitly doesn't do anything,
but everything is consistent.

2) produce the exactly same fit in NNLO --> HERAPDF2.5NNLO-Jets-only CANNOT be done

The HERAPDF2.0jets contains

ZEUS di-jets = 22
DIS JETzeus96/97 = 30
H1 HERA1 highq2 =24
H1 HERA1 lowq2 = 22
H1 2013 inclusive= 24
H1 2013 dijets = 24
H1 2013 trijets = 16

- Firstly trijets are not available at NNLO we HAVE to cut them out
- Secondly there have to be more stringent cuts on the lowQ2 jets at NNLO
- Thirdly we have to cut ~6 data points, and on ZEUS dijets

So we have to make these three changes and then go to stage 2 etc.

Last time I justified a kinematic cut on low Q2 jets $\mu = \sqrt{p_{tave}^2+Q^2} > 13.5$
And the removal of 6 points from ZEUS dijets
on the basis of large scale variations both at NLO and NNLO and unstable scale variations NLO to NNLO, respectively.

This work established that **scale variations** of predictions for a fixed set of PDF parameters are **MUCH smaller at NNLO** (mostly-bar some ZEUS dijet points). Cut is such that points with scale variations>25% NLO and 10% NNLO are cut.

I do not revisit this today

There is a choice of scales to be made for the jets.

For HERAPDF2.0Jets NLO we chose renormalisation =(Q2+pt2)/2, factorisation =Q2
But it turns out that for NNLO jets a choice of renormalisation =(Q2+pt2) is better (better= giving lower chisq $\Delta\chi^2$~ -15)
And for H1 2016 lowQ2 jets factorisation=renorm is MUCH better than Q2 for either choice.
This is quite understandable at lowQ2 and probably should have been used for the older low Q2 data set as well.

In fact the 'optimal' scale choice for NLO and NNLO is different – if optimal means lower chisq. (NLO has lower chisq $\Delta\chi^2$~ -15 for the old scale choice)
Since we are concentrating on NNLO we will use
Renormalisation= Q2 +pt2,
factorisation=Q2+pt2 for low Q2 jets, =Q2 for high Q2 jets
(in practice using Q2+pt2 for high Q2 jets doesn't make a any significant difference)
And we use it for both NNLO and NLO unless otherwise stated

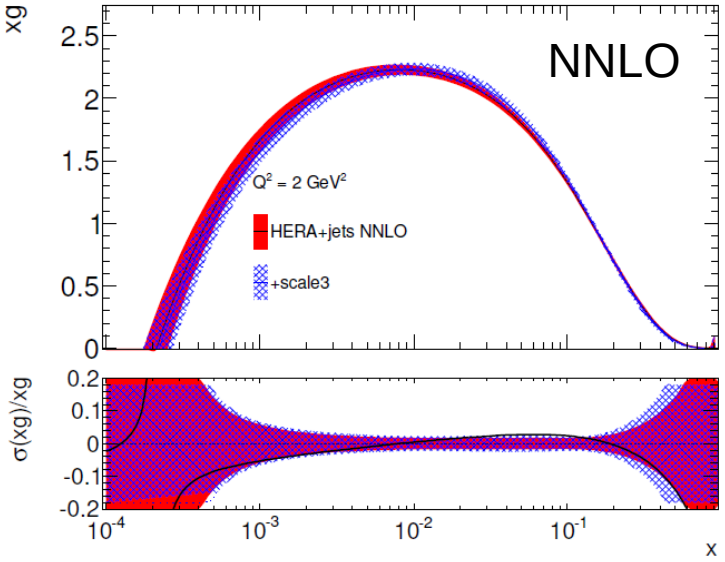
Two more points:

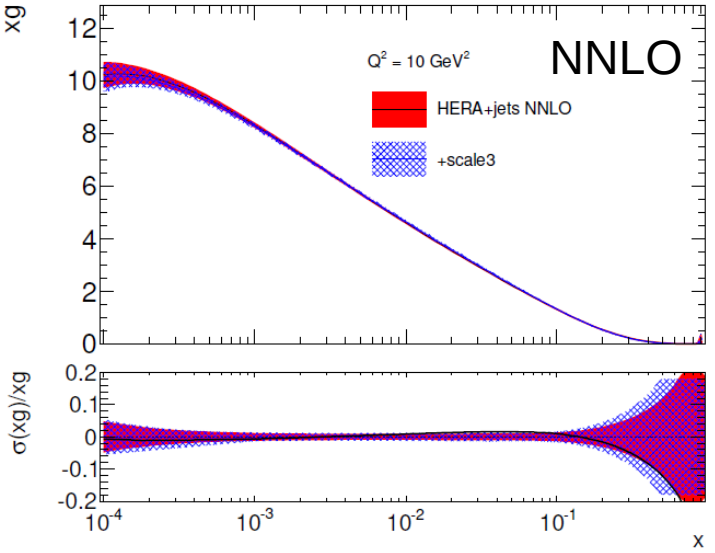
- The new 2016 lowq2 jets have some systematic correlations to the older 2013 high q2 jets– this does not change things much but it is done
- There is an extra low pt bin for the high q2 set, which was published along with the newer low q2 set. We do not use it because we do not yet have the statistical correlations for this bin to the other bins—otherwise all statistical correlation matrices are used by default

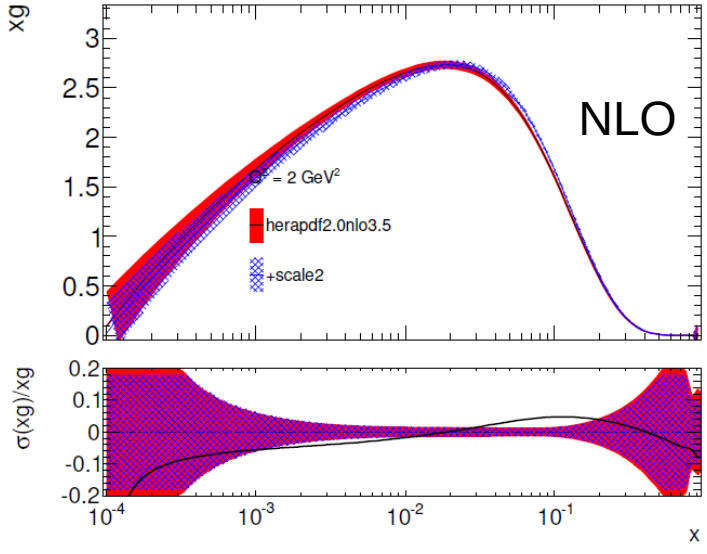
Let's reassure you about scales with a comparison of how much difference this makes at NNLO and NLO (with fixed alphas)

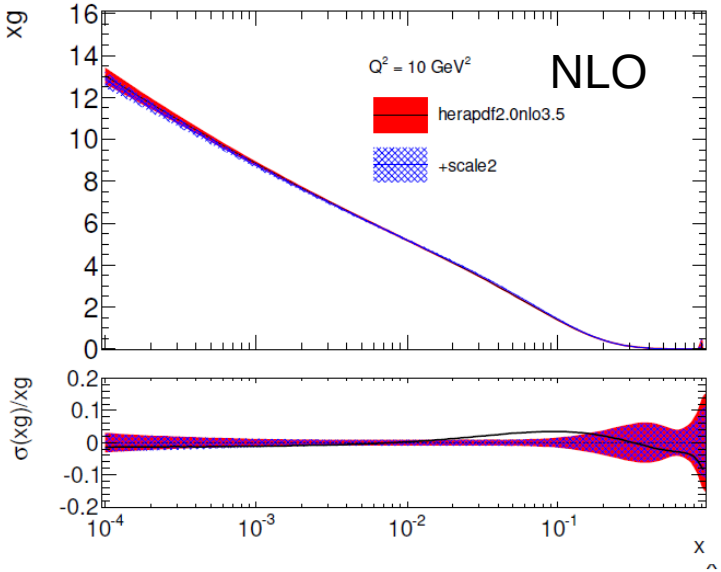
Compare scale 2=(Q2+pt2)/2 and Scale3=Q2+pt2. **What do scale changes do?**

Answer: very little if alphas is fixed



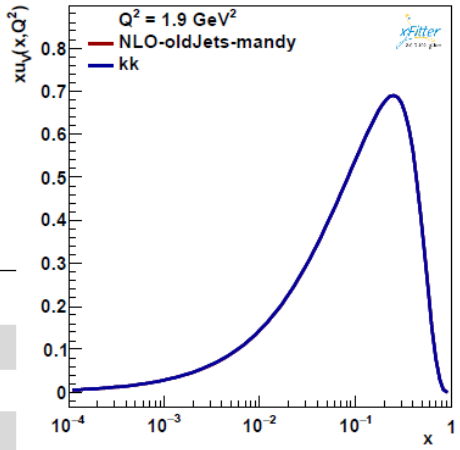


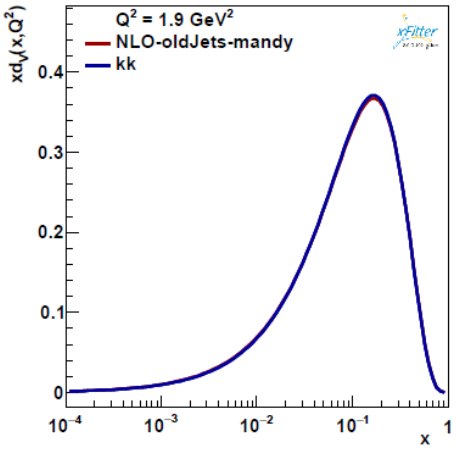


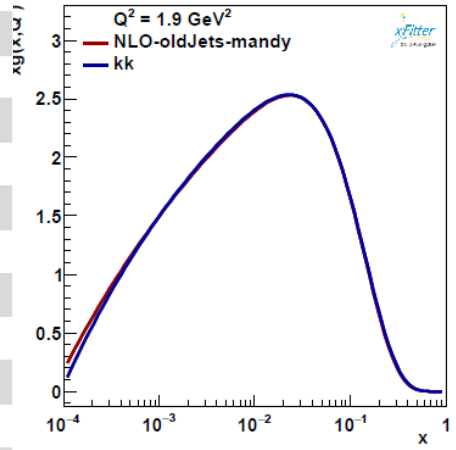


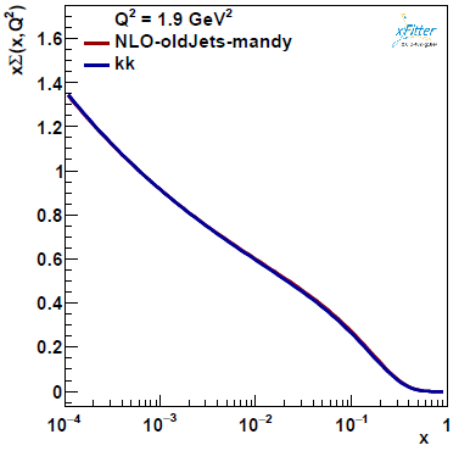
Comparison Katarzyna/me at NLO on final data selection old jets

Parameter	NLO-oldJets-mandy	kk
'Bg'	−0.01 ± 0.16	−0.02 ± 0.17
'Cg'	8.2 ± 1.2	7.89 ± 0.78
'Aprig'	0.9 ± 1.0	0.79 ± 0.81
'Bprig'	−0.172 ± 0.082	−0.191 ± 0.068
'Cprig'	25.00	25.00
'Buv'	0.722 ± 0.038	0.719 ± 0.035
'Cuv'	4.781 ± 0.088	4.817 ± 0.087
'Euv'	12.3 ± 2.3	12.7 ± 2.1
'Bdv'	0.858 ± 0.097	0.873 ± 0.097
'Cdv'	4.26 ± 0.40	4.35 ± 0.41
'CUbar'	7.45 ± 0.84	7.42 ± 0.86
'DUbar'	9.2 ± 3.0	9.4 ± 2.7
'ADbar'	0.176 ± 0.011	0.174 ± 0.011
'BDbar'	−0.1708 ± 0.0072	−0.1726 ± 0.0074
'CDbar'	6.3 ± 1.4	6.9 ± 1.8



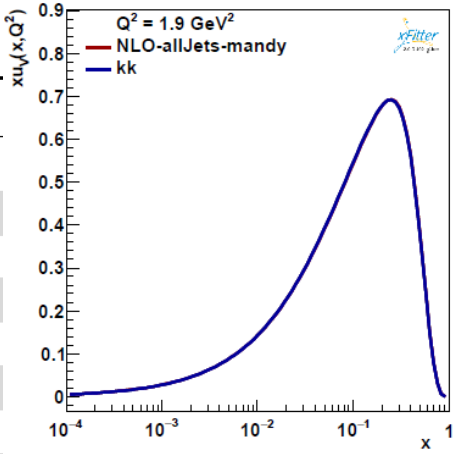


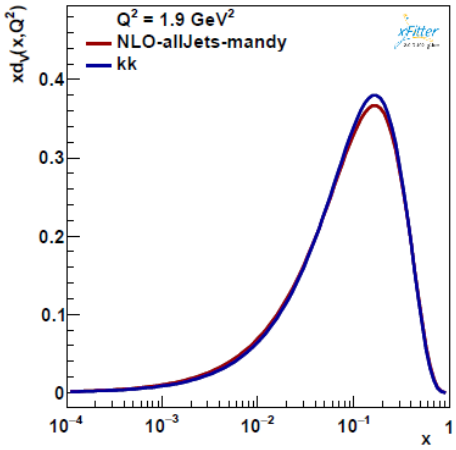


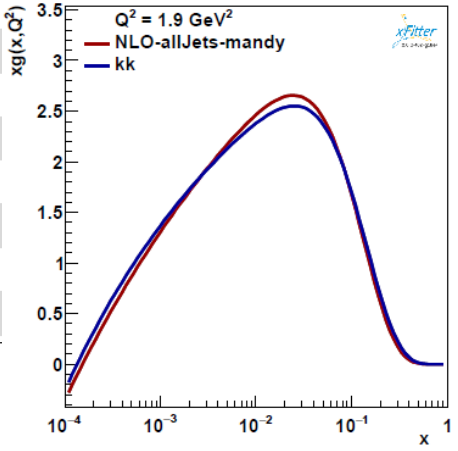


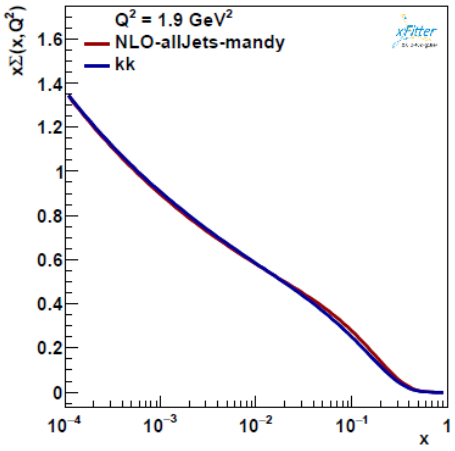
Comparison Katarzyna/me at NLO on final data selection old +new jets

Parameter	NLO-allJets-mandy	kk
'Bg'	−0.00 ± 0.16	−0.04 ± 0.14
'Cg'	9.1 ± 1.2	7.92 ± 0.71
'Aprig'	1.1 ± 1.0	0.97 ± 0.62
'Bprig'	−0.170 ± 0.082	−0.193 ± 0.063
'Cprig'	25.00	25.00
'Buv'	0.730 ± 0.038	0.733 ± 0.032
'Cuv'	4.778 ± 0.088	4.792 ± 0.086
'Euv'	12.0 ± 2.3	11.7 ± 1.8
'Bdv'	0.858 ± 0.097	0.910 ± 0.093
'Cdv'	4.29 ± 0.40	4.54 ± 0.39
'CUbar'	7.95 ± 0.84	7.34 ± 0.91
'DUbar'	12.2 ± 3.0	9.0 ± 2.6
'ADbar'	0.160 ± 0.011	0.1685 ± 0.0094
'BDbar'	−0.1814 ± 0.0072	−0.1762 ± 0.0066
'CDbar'	5.3 ± 1.4	7.3 ± 1.8
'alphas'	0.1180	0.1180





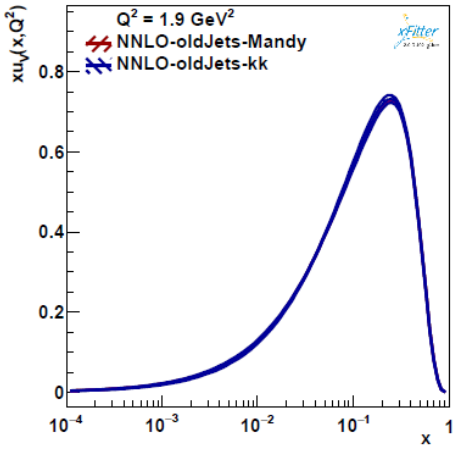


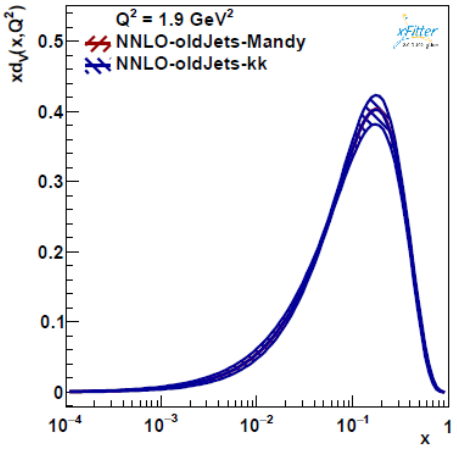


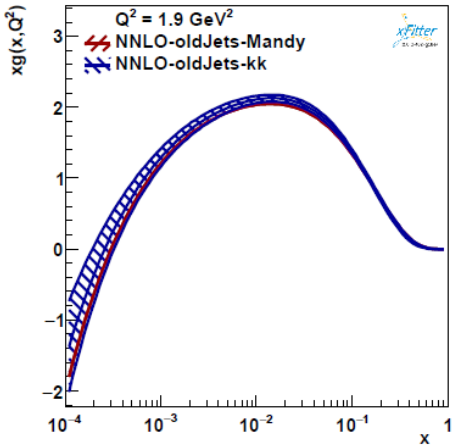
And now some NEW results

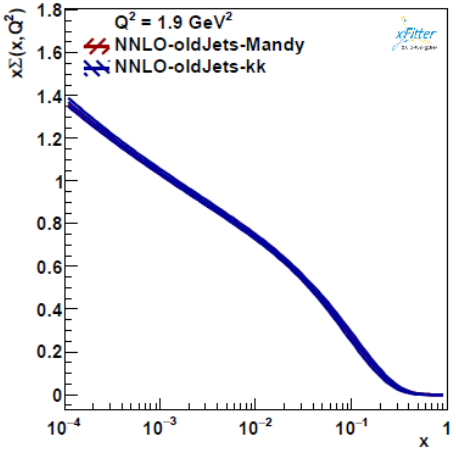
Katarzyna and myself agreement at NNLO first for old jets only

Parameter	NNLO-oldJets-Mandy	NNLO-oldJets-kk
'Bg'	−0.097 ± 0.073	−0.076 ± 0.044
'Cg'	5.02 ± 0.54	5.48 ± 0.50
'Aprig'	0.13 ± 0.12	0.142 ± 0.040
'Bprig'	−0.426 ± 0.060	−0.402 ± 0.030
'Cprig'	25.00	25.00
'Buv'	0.802 ± 0.027	0.811 ± 0.029
'Cuv'	4.812 ± 0.083	4.851 ± 0.084
'Euv'	10.3 ± 1.4	10.3 ± 1.5
'Bdv'	0.998 ± 0.091	0.996 ± 0.088
'Cdv'	4.65 ± 0.39	4.67 ± 0.39
'CUbar'	6.7 ± 1.8	7.2 ± 1.3
'DUbar'	1.7 ± 2.5	1.4 ± 1.5
'ADbar'	0.285 ± 0.012	0.287 ± 0.012
'BDbar'	−0.1196 ± 0.0051	−0.1200 ± 0.0052
'CDbar'	9.2 ± 1.5	8.8 ± 1.5



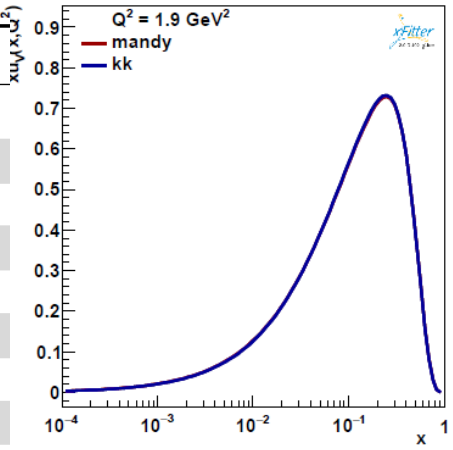


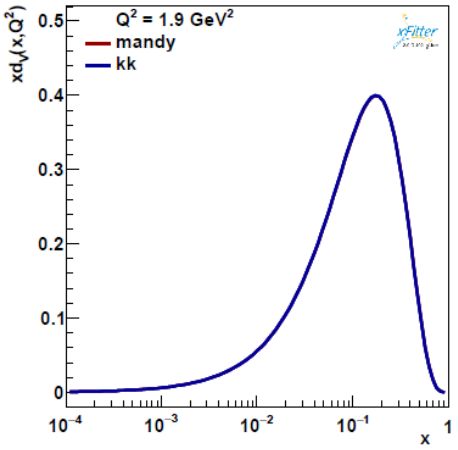


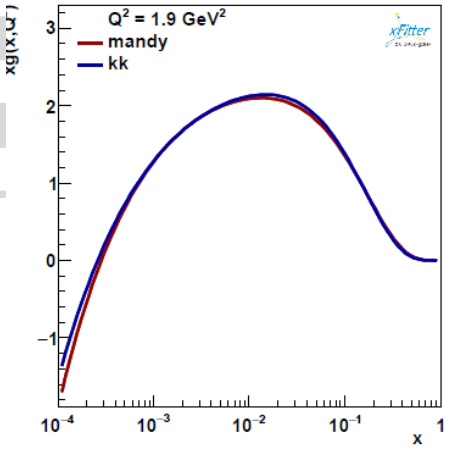


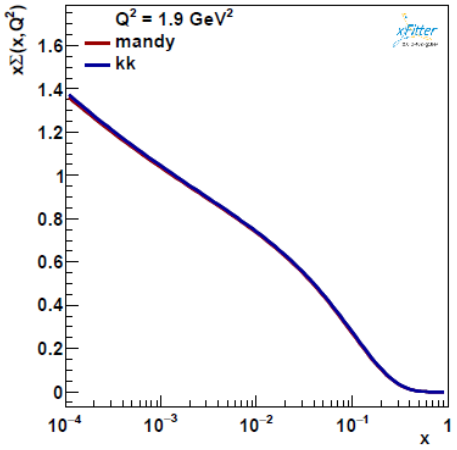
And now Katarzyna/me NNLO for all jets=old+new

Parameter	mandy	kk
'Bg'	−0.097 ± 0.017	−0.072 ± 0.072
'Cg'	5.15 ± 0.26	5.65 ± 0.52
'Aprig'	0.132 ± 0.030	0.15 ± 0.12
'Bprig'	−0.424 ± 0.028	−0.397 ± 0.059
'Cprig'	25.00	25.00
'Buv'	0.801 ± 0.012	0.810 ± 0.027
'Cuv'	4.819 ± 0.051	4.854 ± 0.083
'Euv'	10.42 ± 0.63	10.3 ± 1.4
'Bdv'	0.981 ± 0.044	0.984 ± 0.090
'Cdv'	4.58 ± 0.22	4.62 ± 0.39
'CUbar'	6.77 ± 0.45	7.2 ± 1.9
'DUbar'	0.80 ± 0.72	1.6 ± 2.5
'ADbar'	0.2862 ± 0.0069	0.286 ± 0.011
'BDbar'	−0.1194 ± 0.0032	−0.1207 ± 0.0050
'CDbar'	8.67 ± 0.69	8.4 ± 1.5





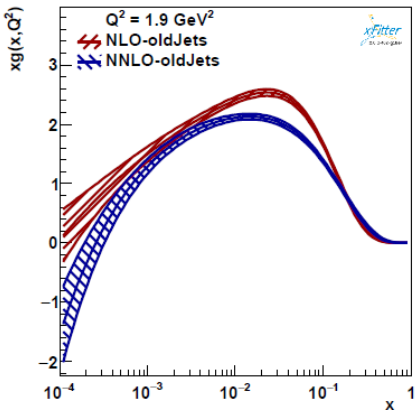


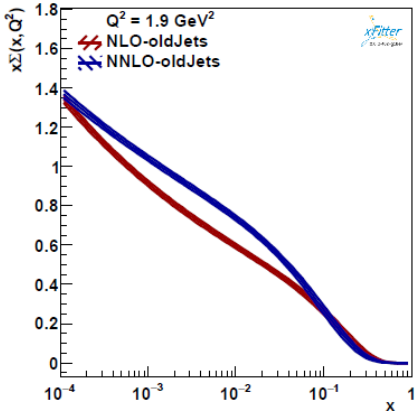


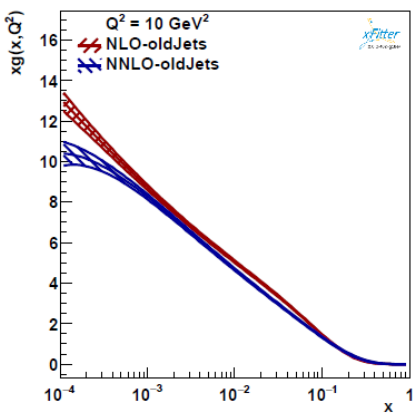
And for this last fit a chisq comparison
This is as good as it has EVER been

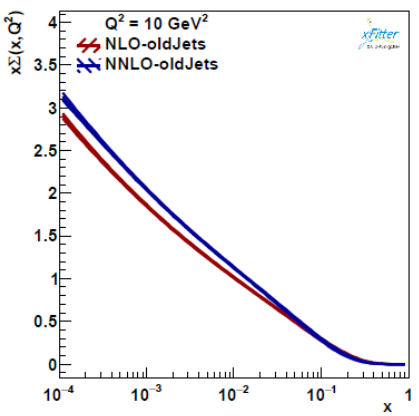
Dataset	mandy	kk
H1 normalised inclusive jet 99-00 data 2	1.5 / 4	1.6 / 4
HERA1+2 CCep	45 / 39	44 / 39
HERA1+2 CCem	58 / 42	57 / 42
HERA1+2 NCem	222 / 159	220 / 159
HERA1+2 NCep 920	450 / 377	443 / 377
HERA1+2 NCep 460	216 / 204	214 / 204
HERA1+2 NCep 575	218 / 254	216 / 254
H1 normalised inclusive jets with unfolding 1	9.9 / 4	10 / 4
H1 normalised inclusive jets with unfolding 2	3.9 / 4	4.0 / 4
H1 normalised inclusive jets with unfolding 3	2.2 / 4	1.8 / 4
H1 normalised inclusive jets with unfolding 4	8.3 / 4	7.8 / 4
H1 normalised inclusive jets with unfolding 5	8.3 / 4	7.3 / 4
H1 normalised inclusive jets with unfolding 6	3.9 / 4	3.9 / 4
H1 normalised dijets with unfolding 1	19 / 4	19 / 4
H1 normalised dijets with unfolding 2	4.5 / 4	4.7 / 4
H1 normalised dijets with unfolding 3	5.9 / 4	6.1 / 4
H1 normalised dijets with unfolding 4	5.6 / 4	5.1 / 4
H1 normalised dijets with unfolding 5	6.0 / 4	5.4 / 4
H1 normalised dijets with unfolding 6	1.8 / 4	1.8 / 4
ZEUS inclusive dijet 98-00/04-07 data 1	2.0 / 4	2.7 / 4
ZEUS inclusive dijet 98-00/04-07 data 2	2.9 / 4	2.7 / 4
ZEUS inclusive dijet 98-00/04-07 data 3	5.9 / 4	6.2 / 4
ZEUS inclusive dijet 98-00/04-07 data 4	1.8 / 4	2.1 / 4
ZEUS inclusive dijet 98-00/04-07 data 5	1.2 / 3	0.90 / 3
ZEUS inclusive dijet 98-00/04-07 data 6	0.67 / 3	0.55 / 3
H1 low Q2 inclusive jet 99-00 data 1	1.0 / 2	1.1 / 2
H1 low Q2 inclusive jet 99-00 data 2	0.37 / 2	0.39 / 2
H1 low Q2 inclusive jet 99-00 data 3	1.4 / 2	1.4 / 2
H1 low Q2 inclusive jet 99-00 data 4	1.1 / 2	1.2 / 2
H1 low Q2 inclusive jet 99-00 data 5	0.20 / 2	0.23 / 2
H1 low Q2 inclusive jet 99-00 data 6	0.81 / 3	0.81 / 3
H1 low Q2 inclusive jet 99-00 data 7	6.3 / 3	6.7 / 3
H1 normalised inclusive jet 99-00 data 1	4.7 / 4	4.8 / 4
H1 normalised inclusive jet 99-00 data 3	1.1 / 4	0.99 / 4
H1 normalised inclusive jet 99-00 data 4	4.1 / 4	4.2 / 4
H1 normalised inclusive jet 99-00 data 5	6.3 / 4	6.7 / 4
H1 normalised inclusive jet 99-00 data 6	8.1 / 4	8.2 / 4
ZEUS inclusive jet 96-97 data 1	4.8 / 5	3.9 / 5
ZEUS inclusive jet 96-97 data 2	5.2 / 5	5.6 / 5
ZEUS inclusive jet 96-97 data 3	5.8 / 5	5.8 / 5
ZEUS inclusive jet 96-97 data 4	9.9 / 5	9.4 / 5
ZEUS inclusive jet 96-97 data 5	3.0 / 5	3.0 / 5
ZEUS inclusive jet 96-97 data 6	4.2 / 5	4.2 / 5
H1 low Q2 inclusive jets normalised 1	4.6 / 4	4.8 / 4
H1 low Q2 inclusive jets normalised 2	3.9 / 4	3.7 / 4
H1 low Q2 inclusive jets normalised 3	1.9 / 4	1.8 / 4
H1 low Q2 inclusive jets normalised 4	2.2 / 4	2.2 / 4
H1 low Q2 inclusive jets normalised 5	1.1 / 4	1.0 / 4
H1 low Q2 inclusive jets normalised 6	4.8 / 4	4.8 / 4
H1 low Q2 inclusive jets normalised 7	1.1 / 4	1.3 / 4
H1 low Q2 inclusive jets normalised 8	5.0 / 4	4.9 / 4
H1 low Q2 dijets normalised 1	2.9 / 4	2.9 / 4
H1 low Q2 dijets normalised 2	2.3 / 4	2.3 / 4
H1 low Q2 dijets normalised 3	1.4 / 4	1.6 / 4
H1 low Q2 dijets normalised 4	2.1 / 4	2.2 / 4
H1 low Q2 dijets normalised 5	0.32 / 4	0.34 / 4
H1 low Q2 dijets normalised 6	0.36 / 4	0.32 / 4
H1 low Q2 dijets normalised 7	1.7 / 4	1.8 / 4
H1 low Q2 dijets normalised 8	1.5 / 4	1.5 / 4
Correlated χ^2	114	115

What does NNLO do ? Fit using inclusive +old jets

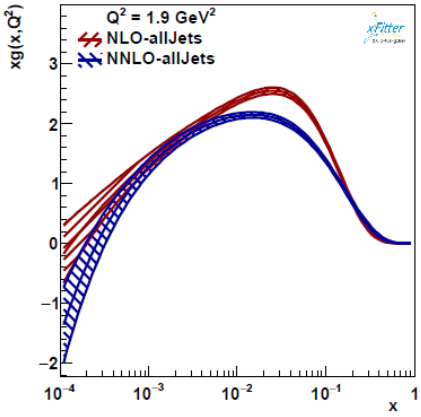


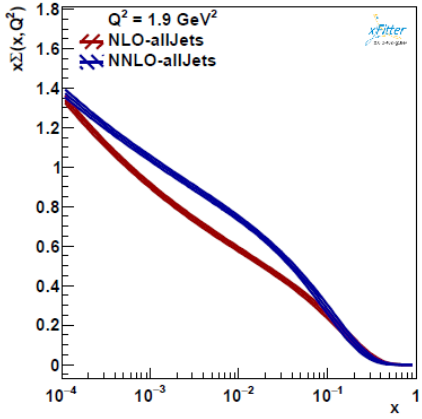


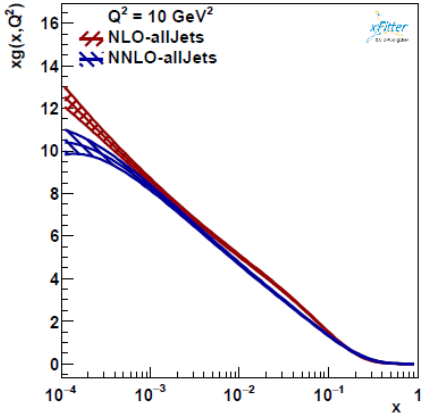


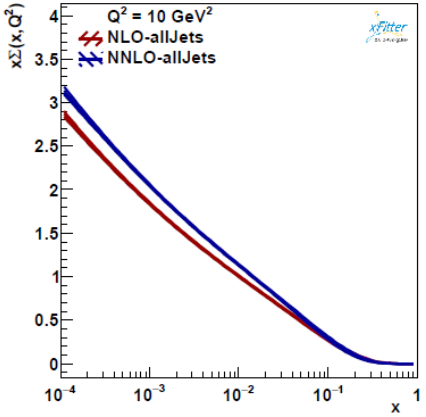


What does NNLO do ? Fit using inclusive +old +new jets









What does NNLO DO?
Answer: the same as it did for inclusive

The plots at Q2=10 Gev2 look just like the NNLO to NLO plots in the HERAPDF2.0 paper for inclusive only

Some remarks on chisq

Numbers are partial chisq plus relevant part of correlated chisq

	NNLO		NLO	no of pts
H1 norm jets old	24.3	||	18.4	24
H1 lowQ2 old	12.0	||	13.5	16
ZEUS inclusive	30.0	||	29.5	30
ZEUS dijets	22.9	||	18.7	16

All these jets have similar NLO and NNLO chisq

H1 2013 highQ2 inclusive				
H1 2013 highQ2 dijets	90.8	||	70.4	48

The h1 high Q2 jets have larger NNLO chisq

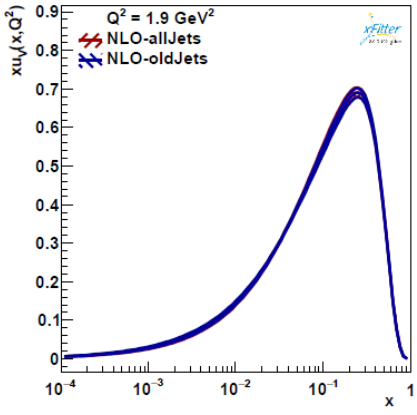
H1 2016 lowQ2 inclusive				
H1 2016 lowQ2 dijets	58.8	||	141.8	64

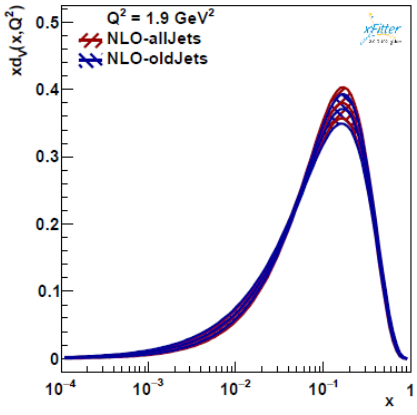
But the h1 low Q2 jets have smaller NNLO chisq

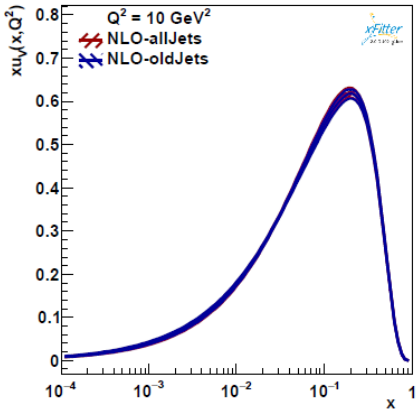
As already presented in previous H1/ZEUS meetings these figures are broadly in agreement with the findings of the H1 jet studies

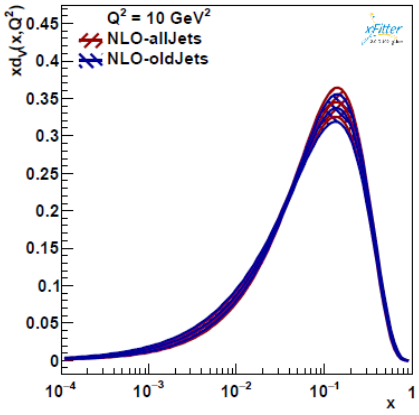
As an aside the hadronisation systematic uncertainty—which is ONLY used for the new 2016 jets (it was offset in the past) ---contributes a much larger amount to the NLO correlated chisq than it does to the NNLO correlated chisq

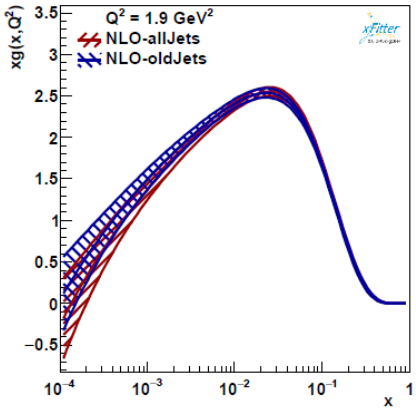
What do new jets do? NLO

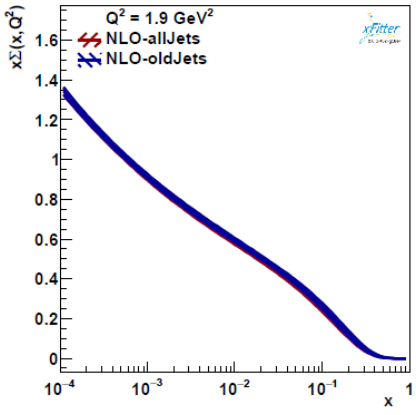


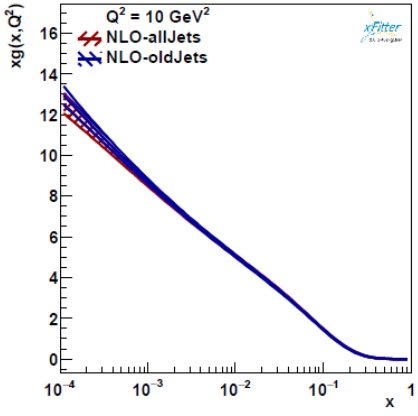


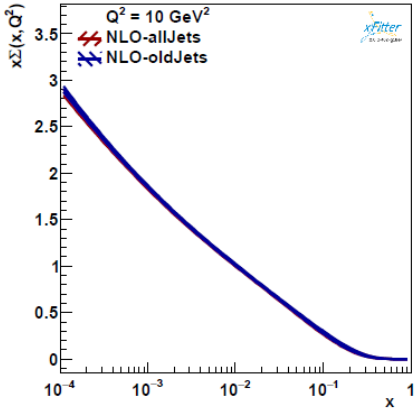


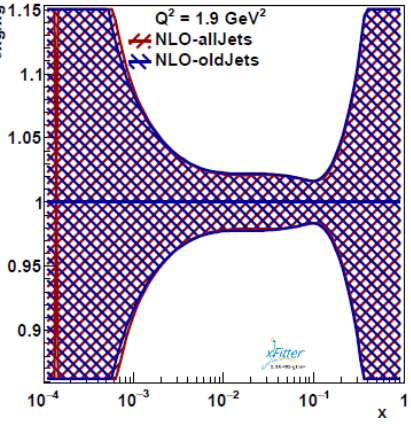




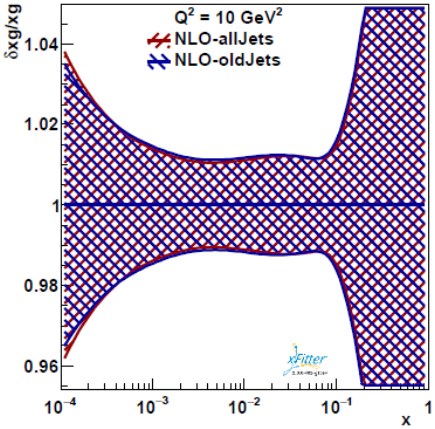




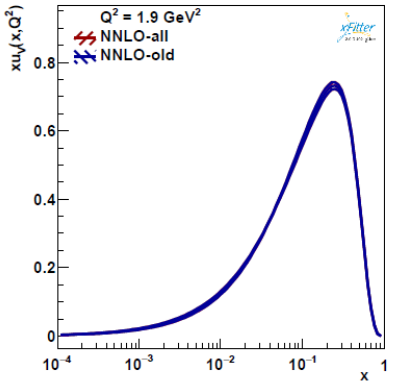


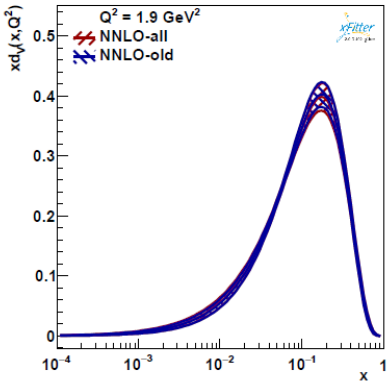


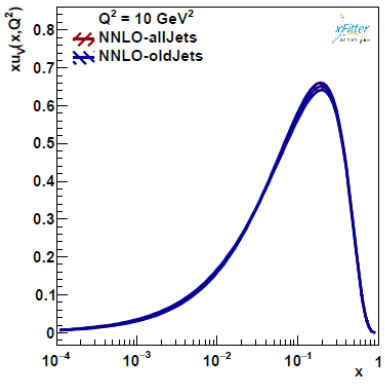
The answer is: not a lot when alphas is fixed

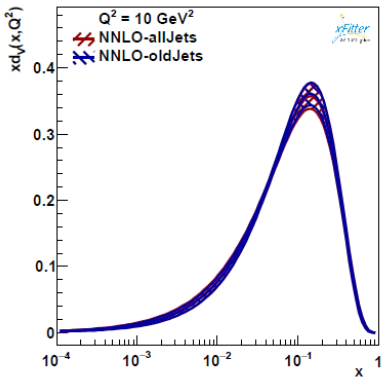


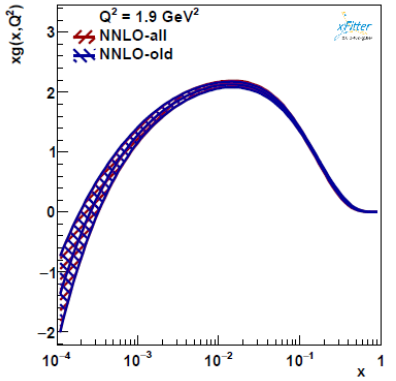
What do new jets do? NNLO

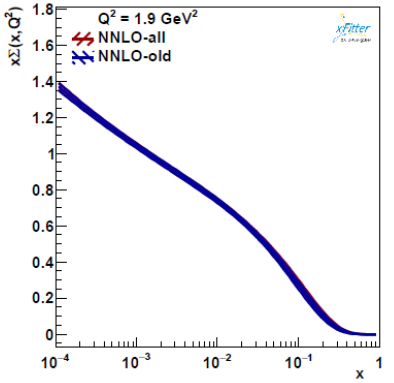


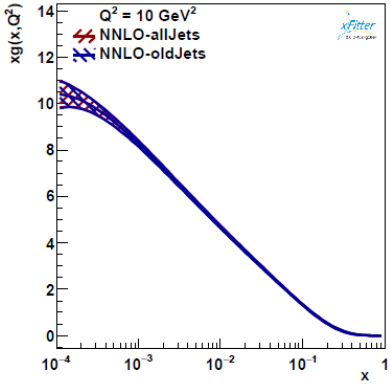


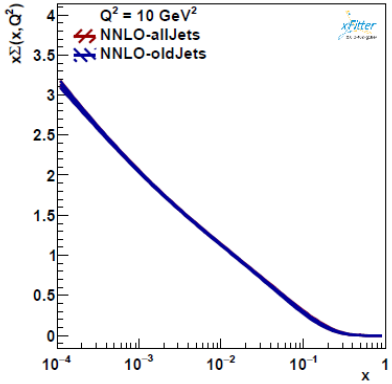


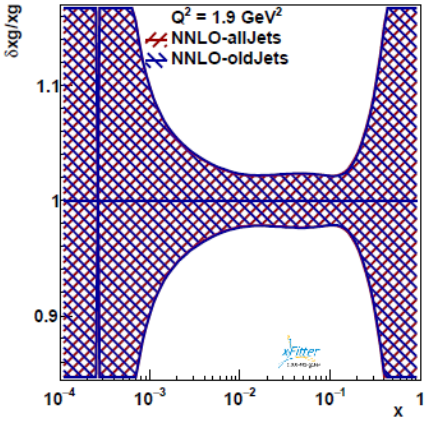




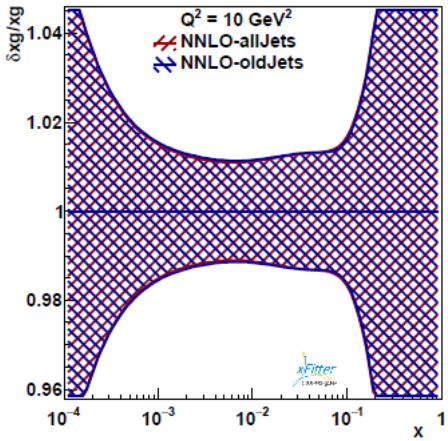




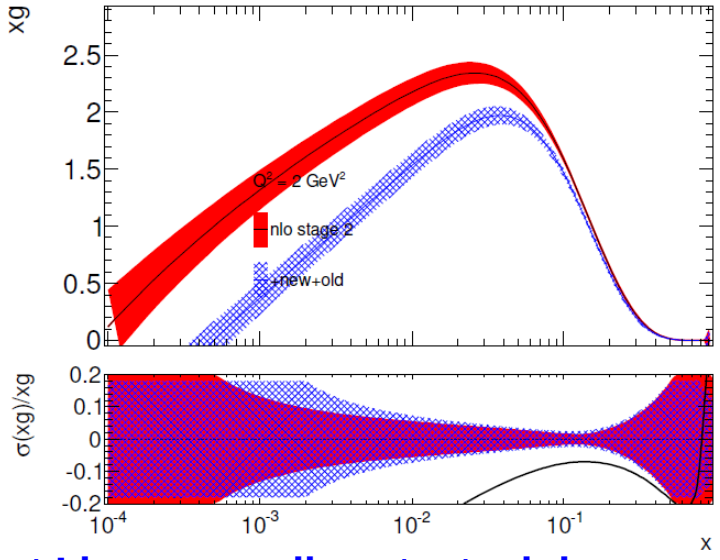




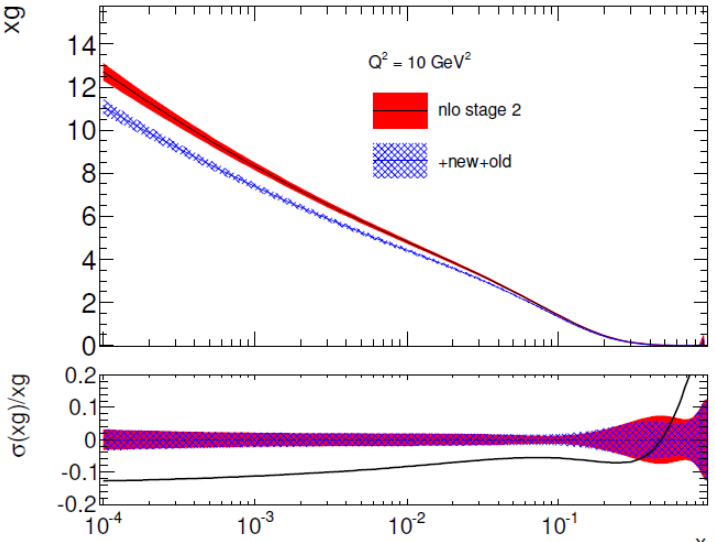
The answer is: not a lot when alphas is fixed



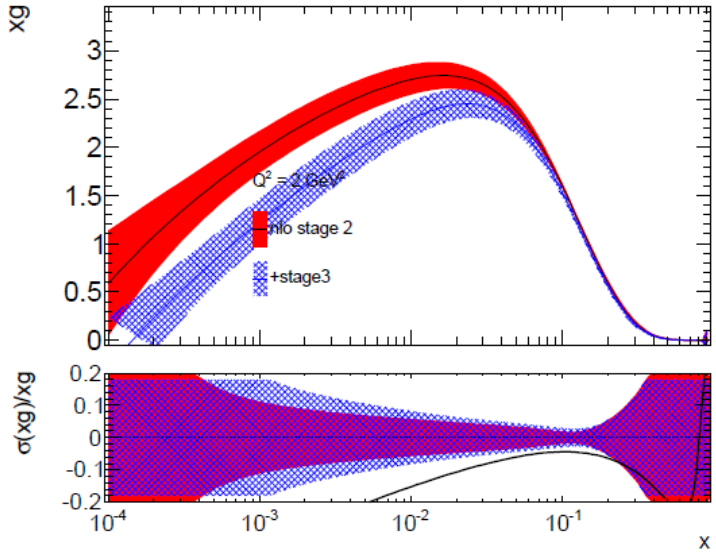
Now what do new jets do? With free alphas ($\alpha_s(M_Z)$)
At NLO and new scale=Q2+pt2. **Answer they change alphas from 0.120 to 0.124**



New scales

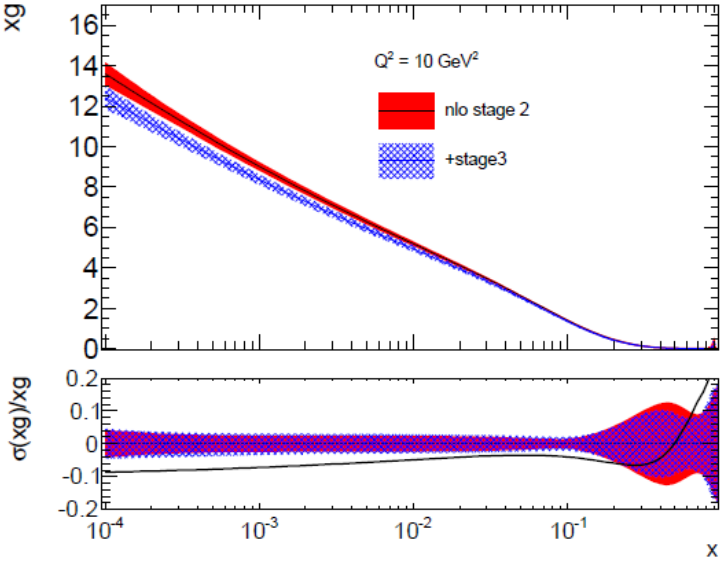


But I hear you all protest, alphas was not 0.120 for our old jets HERAPDF2.0, it was 0.118!
YES because we used a different scale, using (Q2+pt2)/2 we get an alphas change 0.117 to 0.121, with the new jets. 0.117 is compatible with 0.118 given that we discarded some jet data

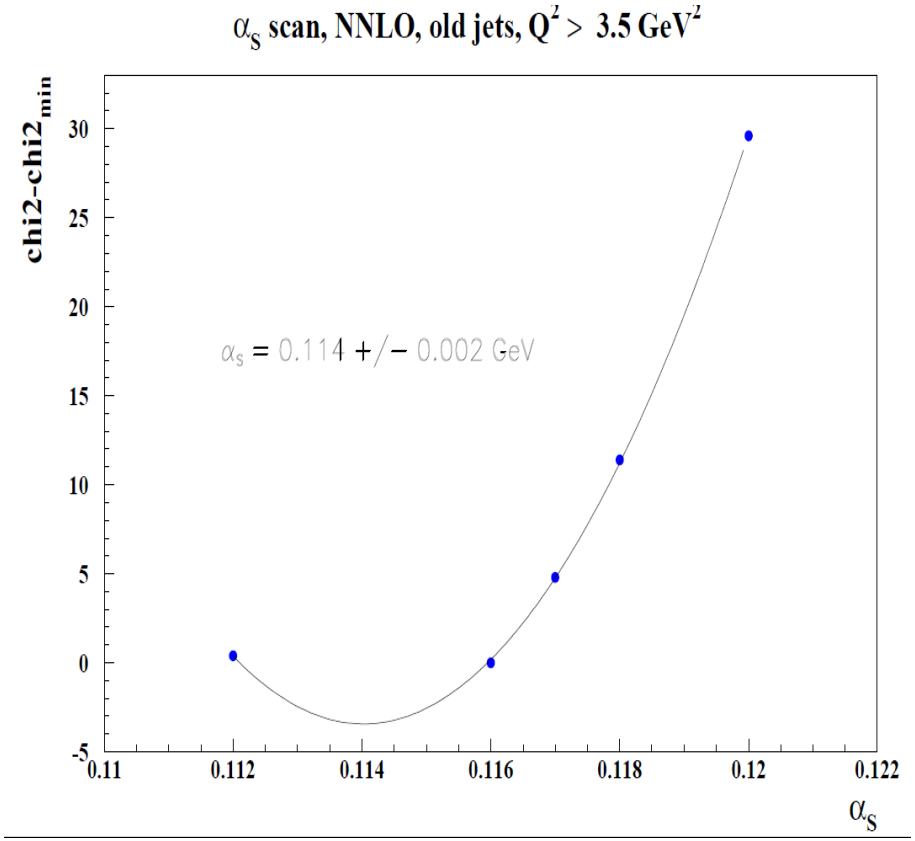


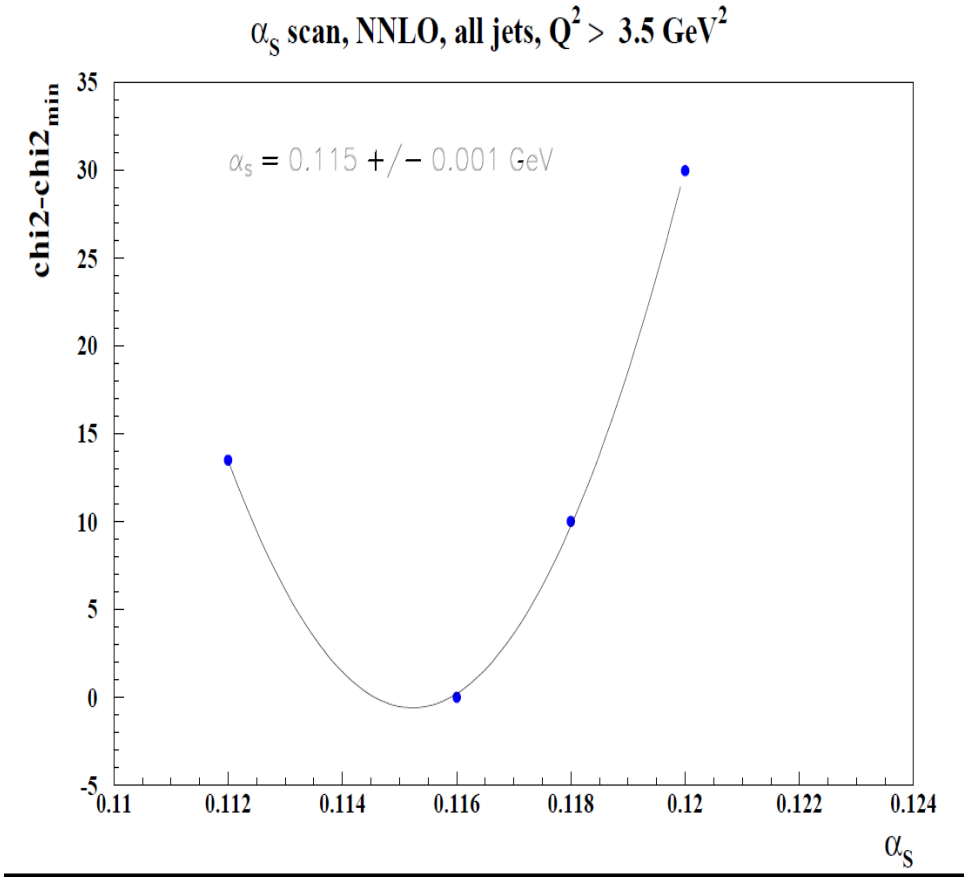
And the change in alphas with scale is compatible with our previous estimates of NLO scale uncertainty

Old scales



Now that was for NLO alphas free fits
Both Katarzyna and I have difficulty fitting alphas at NNLO
So to address this we have been scanning over different fixed alphas values trying to Determine alphas at NNLO
Currently with scale choice Q2+pt2





BUT stop press—we have an NNLO fit AND an estimate of scale uncertainty

For NNLO alphas free and old+new jets

Parameter	asFree-NNLO-allJets-scales	asFree-NNLO-allJets
'Bg'	−0.109 ± 0.013	−0.087 ± 0.012
'Cg'	6.37 ± 0.16	6.16 ± 0.14
'Aprig'	0.117 ± 0.021	0.128 ± 0.014
'Bprig'	−0.443 ± 0.031	−0.422 ± 0.021
'Cprig'	25.00	25.00
'Buv'	0.7606 ± 0.0081	0.7815 ± 0.0063
'Cuv'	4.919 ± 0.040	4.889 ± 0.033
'Euv'	10.76 ± 0.42	10.39 ± 0.32
'Bdv'	0.988 ± 0.032	1.002 ± 0.026
'Cdv'	4.99 ± 0.17	4.92 ± 0.14
'CUbar'	7.30 ± 0.27	7.32 ± 0.22
'DUbar'	2.75 ± 0.45	2.39 ± 0.37
'ADbar'	0.2744 ± 0.0052	0.2731 ± 0.0042
'BDbar'	−0.1234 ± 0.0025	−0.1246 ± 0.0020
'CDbar'	11.38 ± 1.00	10.43 ± 0.74
'alphas'	0.11328 ± 0.00058	0.11505 ± 0.00056

Old Scale choice (Q2+pt2)/2

Our scale choice Q2+pt2

Estimate of NNLO scale uncertainty ~-0.0017

Note using a scale change of √2 as done here is a rough and ready way of estimating a scale change of 2 – but applies ½ correlated and ½ uncorrelated as we did for HERAPDF2.0Jets---we got +0.0037/-0.0030 for HERAPDF2.0jets

For NLO alphas free and old+new jets

Parameter	NLO-allJets-asFree-testScales	NLO-nominal-scales
'Bg'	0.009 ± 0.025	0.019 ± 0.025
'Cg'	7.97 ± 0.35	7.30 ± 0.34
'Aprig'	0.78 ± 0.13	1.14 ± 0.15
'Bprig'	−0.184 ± 0.020	−0.139 ± 0.017
'Cprig'	25.00	25.00
'Buv'	0.726 ± 0.016	0.775 ± 0.016
'Cuv'	4.798 ± 0.061	4.698 ± 0.061
'Euv'	13.41 ± 0.96	11.77 ± 0.87
'Bdv'	0.799 ± 0.053	0.852 ± 0.055
'Cdv'	3.98 ± 0.26	4.08 ± 0.26
'CUbar'	7.80 ± 0.46	7.50 ± 0.52
'DUbar'	10.8 ± 1.4	8.8 ± 1.4
'ADbar'	0.1687 ± 0.0061	0.1656 ± 0.0060
'BDbar'	−0.1785 ± 0.0045	−0.1842 ± 0.0045
'CDbar'	4.16 ± 0.69	3.76 ± 0.63
'alphas'	0.12056 ± 0.00067	0.12390 ± 0.00065

Old Scale choice (Q2+pt2)/2

Our scale choice Q2+pt2

Estimate of NLO scale uncertainty ~-0.0033

Without new jets at NLO
Our scale=0.1201± 0.0007
Old scale =0.1172± 0.0007
Cf result 0.1183±0.0009 from HERAPDF2.0 – consistent given that some data sets/points were moved

Preliminary conclusions

What does NNLO do?

- It changes the shapes of the gluon and sea PDFs in the same way as it did for inclusive only fits
- It gives better fits to the recent H1 low Q2 jet data set, but worse to that of the 2013 H1 high Q2 data set, other jet data set chisq are not much affected.

The inclusive data is somewhat worse fit-as was also true in inclusive alone fits- this is a low-x issue

- It decreases scale uncertainty
- It decreases the value of $\alpha_S(M_Z)$

What do new low Q2 jets do?

No significant changes at fixed $\alpha_S(M_Z)$

When $\alpha_S(M_Z)$ is free it raises the value of $\alpha_S(M_Z)$ at NLO, by ~0.004, with corresponding change in gluon shape. This change is broadly compatible with NLO scale uncertainty.

However at NNLO there is not much difference in $\alpha_S(M_Z)$ with or without the new jets. The NNLO value of

$\alpha_S(M_Z) = 0.1151 \pm 0.0006(\text{exp}) \pm 0.0001(\text{model}) \pm 0.0017(\text{scale})$ $\pm ?(\text{hadronisation})$ $\pm ?(\text{param not done yet})$

The methods to determine hadronisation and scale uncertainty could be discussed..
Hadronisation is not currently treated consistently

Back-up

FEB 14th START AGAIN

Agreement with Katarzyna reached!! For NNLO fits

Basic fit NNLO stage 3 old+new alphas fixed fit scale=2=q2+pt2 renorm and fac for lowq2jets BUT fac=Q2 for highq2 jets (probably does not matter too much).

On **/mandy/nnlojets/lowq2jets/alf113 alf112 has other scale=3** (so can compare sclaes) 1,2

And errors OK

Compare to stage 2 old jets **what do new jets do** on nnlojets/scale2 errors also OKAy—sorry not quite okay, and now went **gaga—errors misleading before in current plots—maybe not Katarzyna also has this—re-running—is gaga again**

Then compare to **NLO** stage 3 old+new alphas fixed with these scales=2 on .mandy/lowq2jets **what does NNLO do?—**again sorry not quite okay it's the small posdef –cant fix it, have replaced no tricks still posdef

All three of these comparisons on alf113/plots

And Mandy/scale2 is NLO stage 2 old OKAy to compare oldjets to old+new at NLO or NLO to NNLO for old? Almost OKAy but slightly different-OKAYish posdef—HA

VE replaced it no tricks plot of old to old+new/nlo is on Mandy/lowq2jets/plots

Try NLO alphas free oldjets on Mandy/alphas and old+new on lowq2jets/alfix yes ironically =0.120 and 0.124 resp..scale 2, scale 3 (as earlier)was 0.117 and 0.121 resp.

NOW SET UP **alphas NNLo scan**.. But ALSO make plots with Mandy Scale2 organise.

Do it in nnlojets/lowq2jets/alf114,115,116,117,118?—**tendency to 0.114—but** some fail

Assemble brief history of what we have left out and justification of scalemu cut on scale uncertainties
Show agreement me/K at Nlo –did it have new jets, YES and its old don't show again
Then show agreement of me/K at NNLO—although this is for old+new right now.

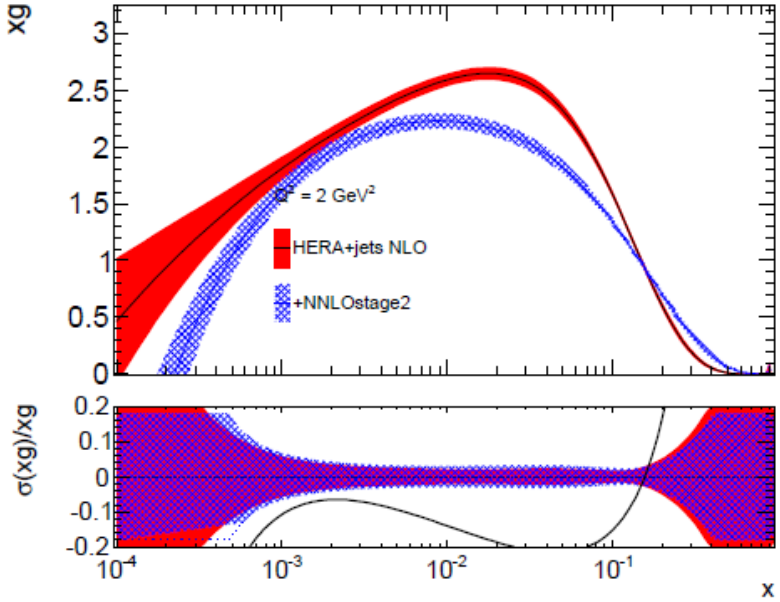
THEN Show NNLo to NLO old and NNLo to NLO old+new at 10 GeV
NNLO to NLO old+new is on Mandy/nnlojets/lowq2jets/alf113
Acnt do NNLO to NLO just old because NNLO job nnlojets/scale2 is gaga to compare Mandy/scale2 (but I try again-still doesn't work
Then show NNLO old+new/old—no difference on Mandy/nnlojets/lowq2jets/alf113
Also show NLO old+new/old– small difference on Mandy/lowq2jets/plots

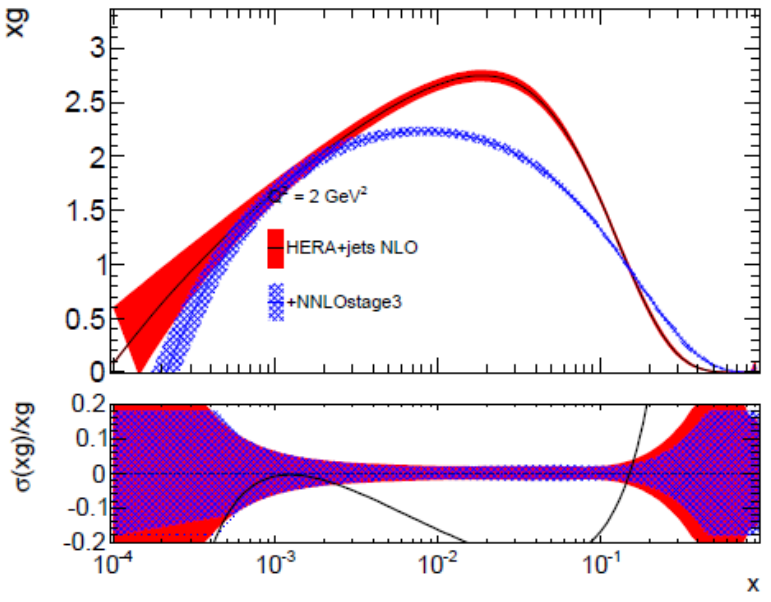
Show one job at NNLo with different scales to show no matter but chisq better
Also on Mandy/nnlojets/lowq2jets/alf113
No such Nlo scale comparison yet but I KNOW it shows a BIT more difference

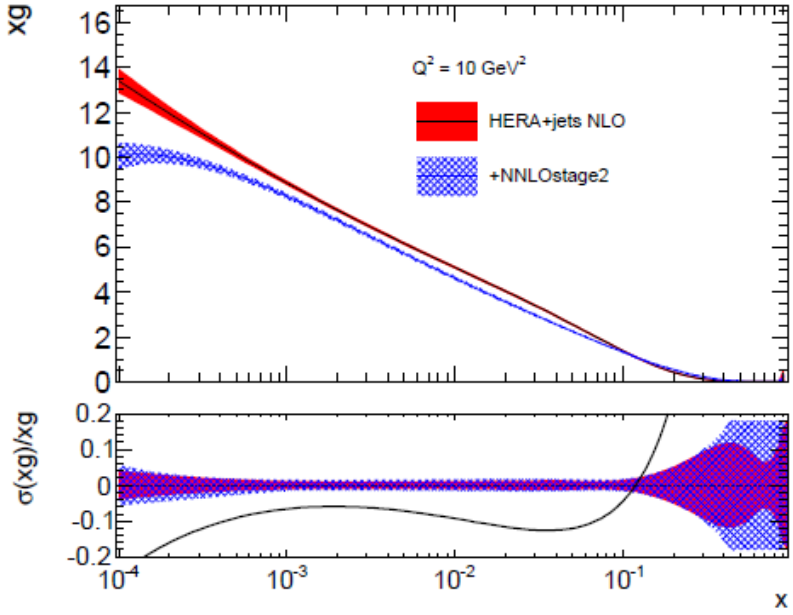
Then show free alphas at NLO old and old +new..this changes with scale
0.117 to 0.121 becomes 0.120 to 0.124..use tricks for me but she does not
Did have plot to show difference in gluon for the 0.117/0.121 case—can make new one comparing Mandy/lowq2jets/alfix to Mandy/alphas
Point is newjets DOES do something

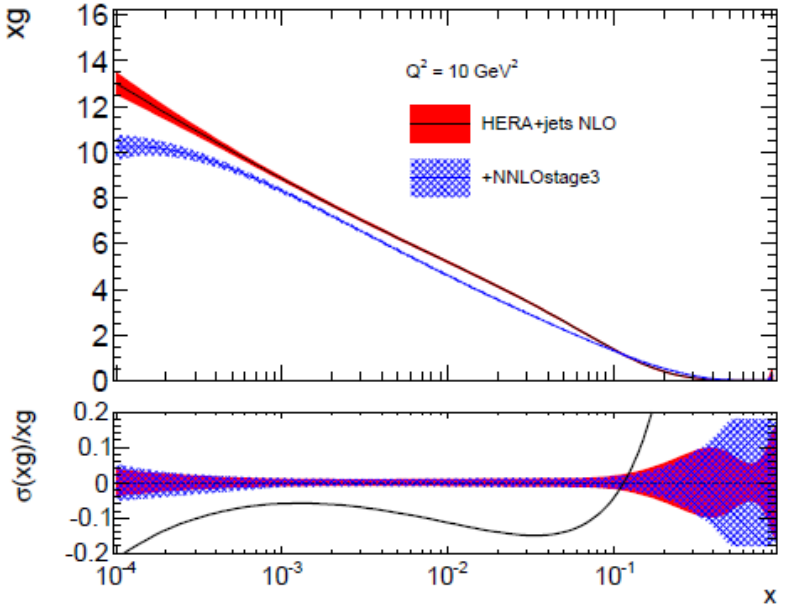
THEN go to NNLO scans where it looks like it doesn't do much—but needs more work!
Old+new nnlojets/lowq2jets/alf117 to114 –try again nearer ?? Ie use successful lower alphas job as the start?? Rerunning 0.114 an 0.115
Old nnlojets/alf114 etc also exists not done yet—set up for 0.114 to 0.117 and re-run 0.118 as above on scale2 directory

Now show NNLO vs NLO at stage2=old jets and stage3=old+new jets
(but for previous scale choice, (Q2+pt2)/2), **what does NNLO do?**









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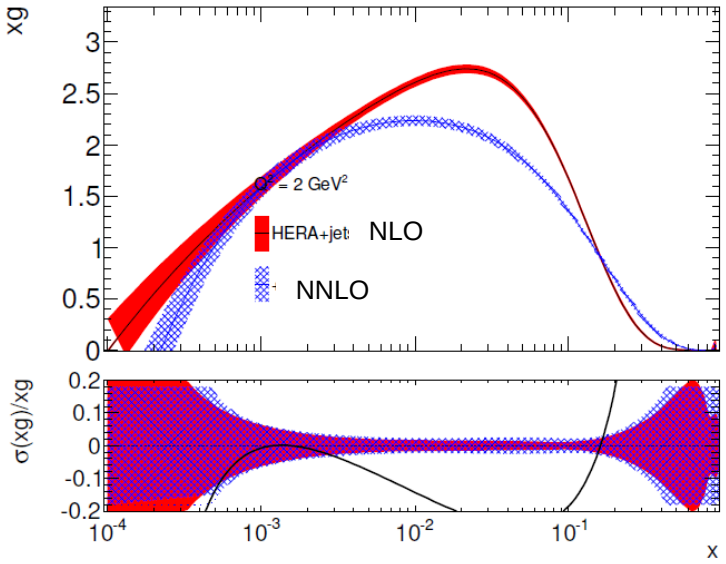
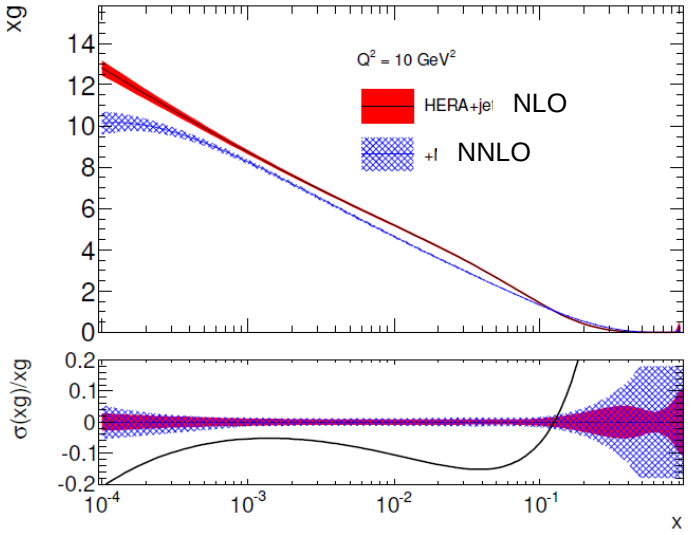
NNLO to NLO for old + new jets, new scale

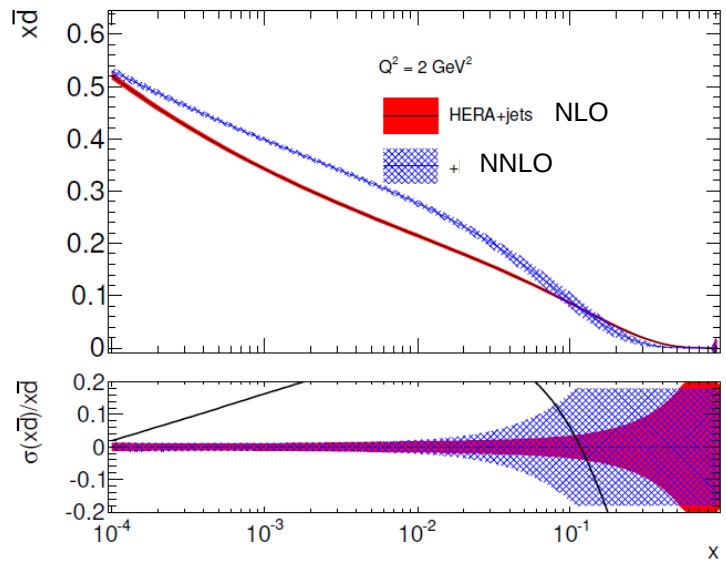
I,e What does NNLO DO?

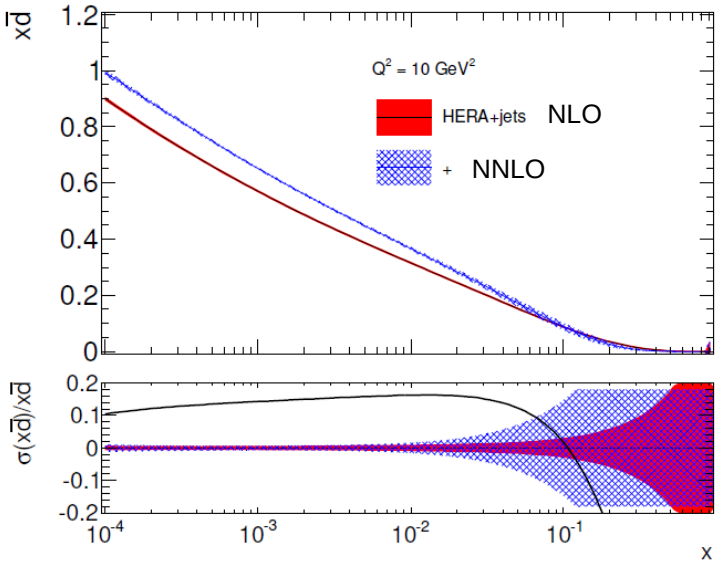
Answer: the same as it did for inclusive

These plots at Q2=10 Gev2 look just like the NNLO to NLO plots in the paper for inclusive only

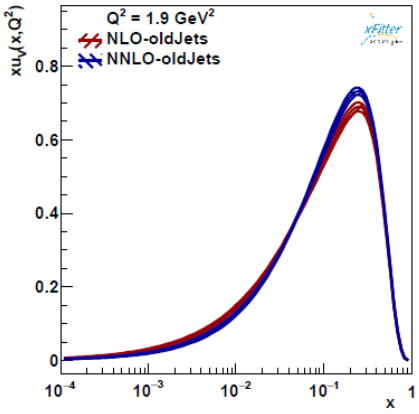


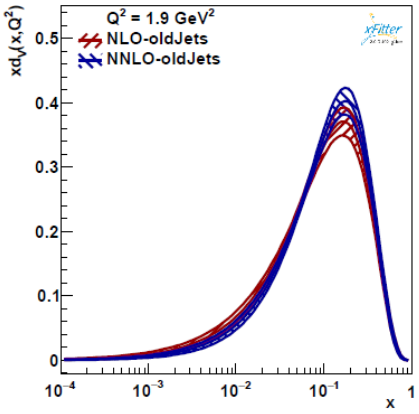


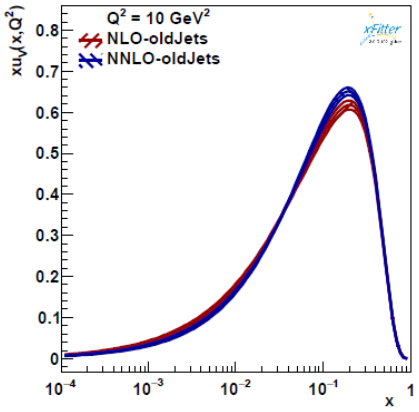


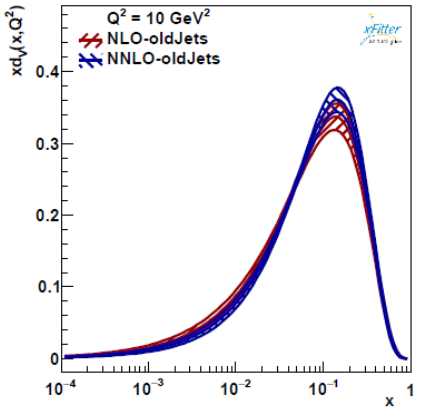


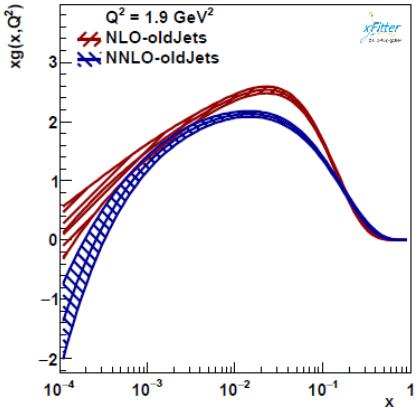
What does NNLo do ? To old jets

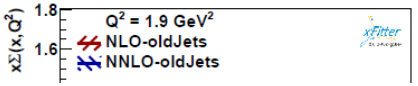


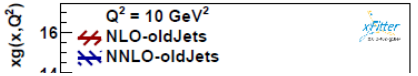


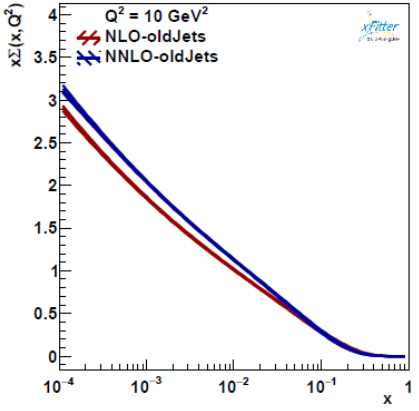








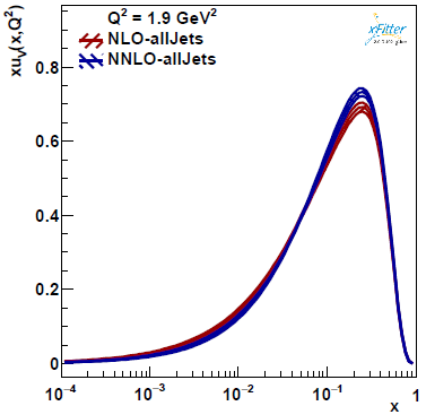


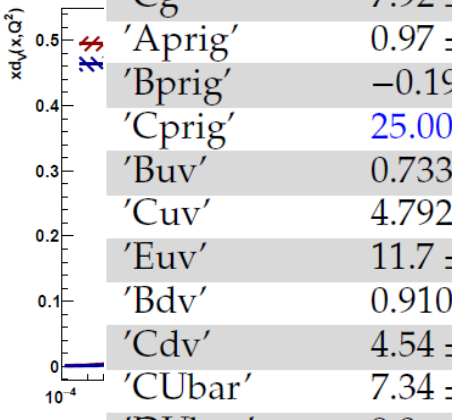


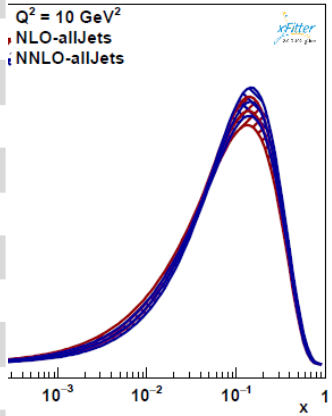
Parameter	NLO-oldJets	NNLO-oldJets
'Bg'	−0.021 ± 0.077	−0.076 ± 0.044
'Cg'	7.89 ± 0.55	5.48 ± 0.50
'Aprig'	0.79 ± 0.26	0.142 ± 0.040
'Bprig'	−0.191 ± 0.041	−0.402 ± 0.030
'Cprig'	25.00	25.00
'Buv'	0.719 ± 0.029	0.811 ± 0.029
'Cuv'	4.817 ± 0.083	4.851 ± 0.084
'Euv'	12.7 ± 1.6	10.3 ± 1.5
'Bdv'	0.873 ± 0.085	0.996 ± 0.088
'Cdv'	4.35 ± 0.38	4.67 ± 0.39
'CUbar'	7.42 ± 0.79	7.2 ± 1.3
'DUbar'	9.4 ± 2.0	1.4 ± 1.5
'ADbar'	0.1742 ± 0.0086	0.287 ± 0.012
'BDbar'	−0.1726 ± 0.0059	−0.1200 ± 0.0052
'CDbar'	6.9 ± 1.3	8.8 ± 1.5

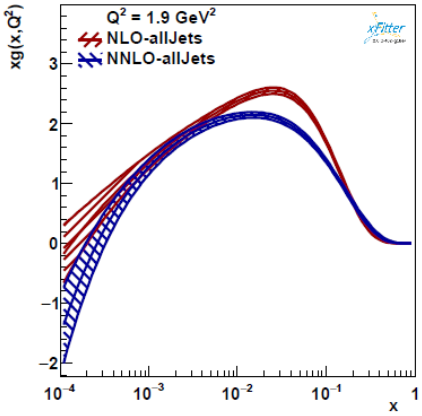
What does NNLo do ? To old +new jets

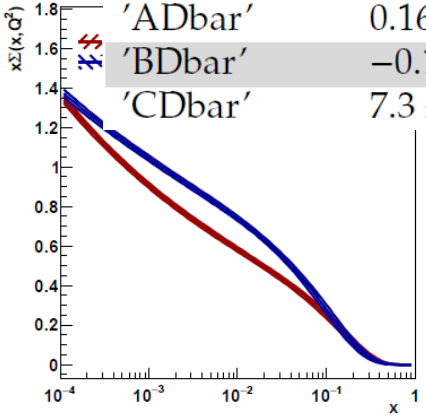
Parameter	NLO-allJets	NNLO-allJets
'Bg'	−0.039 ± 0.079	−0.071 ± 0.045
'Cg'	7.92 ± 0.55	5.72 ± 0.50
'Aprig'	0.97 ± 0.27	0.152 ± 0.042
'Bprig'	−0.193 ± 0.045	−0.395 ± 0.030
'Cprig'	25.00	25.00
'Buv'	0.733 ± 0.028	0.810 ± 0.030
'Cuv'	4.792 ± 0.084	4.856 ± 0.084
'Euv'	11.7 ± 1.5	10.4 ± 1.5
'Bdv'	0.910 ± 0.091	0.979 ± 0.095
'Cdv'	4.54 ± 0.40	4.59 ± 0.41
'CUbar'	7.34 ± 0.85	7.3 ± 1.3
'DUbar'	9.0 ± 2.1	1.7 ± 1.6
'ADbar'	0.1685 ± 0.0081	0.285 ± 0.012
'BDbar'	−0.1762 ± 0.0057	−0.1211 ± 0.0052
'CDbar'	7.3 ± 1.4	8.2 ± 1.5

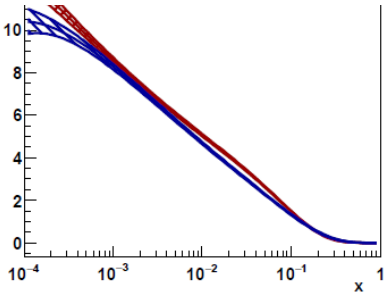


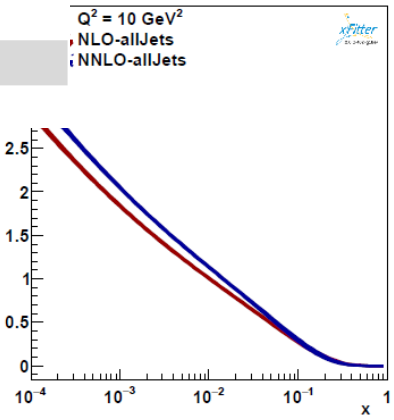




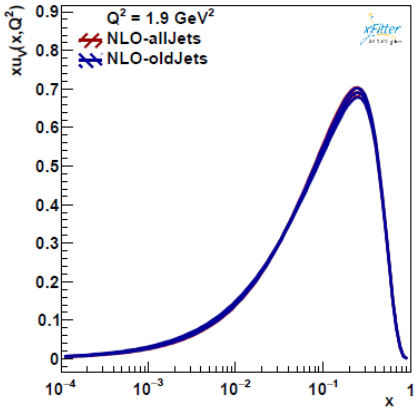


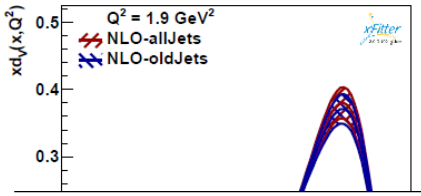


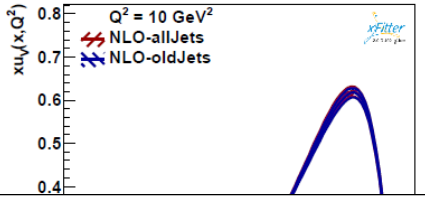


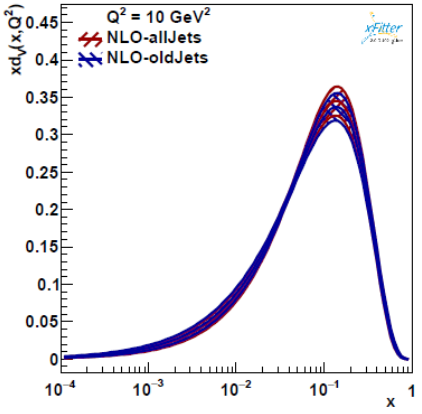


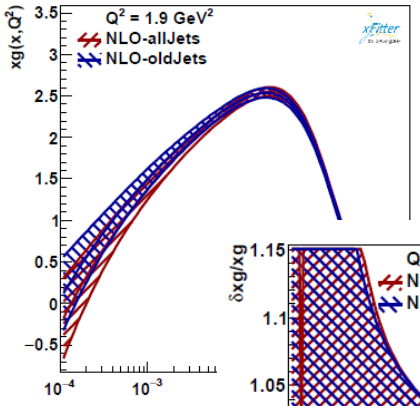
What do new jets do? NLO

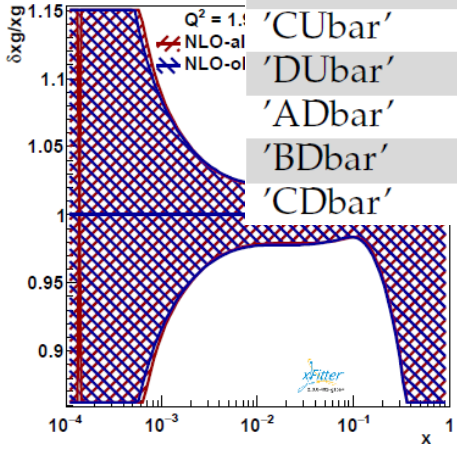




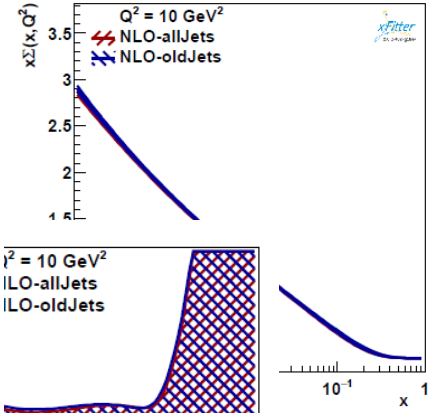


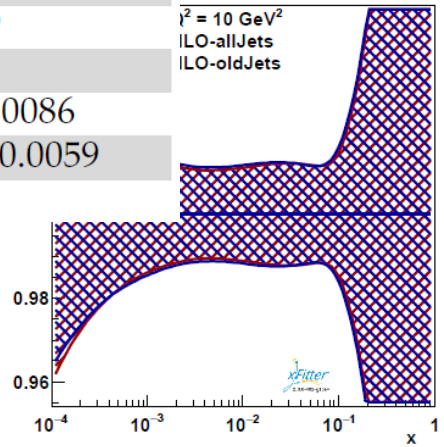




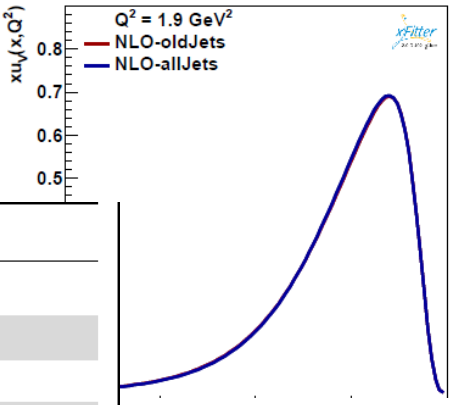


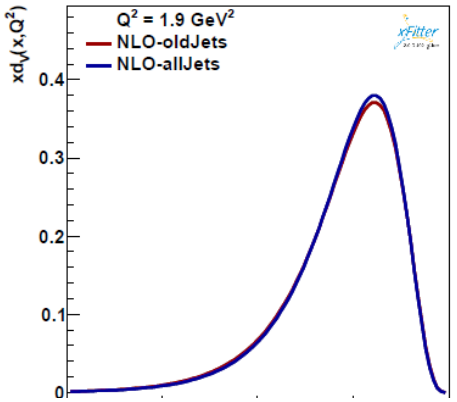
Parameter	NLO-allJets	NLO-oldJets
'Bg'	−0.039 ± 0.079	−0.021 ± 0.077
'Cg'	7.92 ± 0.55	7.89 ± 0.55
'Aprig'	0.97 ± 0.27	0.79 ± 0.26
'Bprig'	−0.193 ± 0.045	−0.191 ± 0.041
'Cprig'	25.00	25.00
'Buv'	0.733 ± 0.028	0.719 ± 0.029
'Cuv'	4.792 ± 0.084	4.817 ± 0.083
'Euv'	11.7 ± 1.5	12.7 ± 1.6
'Bdv'	0.910 ± 0.091	0.873 ± 0.085
'Cdv'	4.54 ± 0.40	4.35 ± 0.38
'CUbar'	7.34 ± 0.85	7.42 ± 0.79
'DUbar'	9.0 ± 2.1	9.4 ± 2.0
'ADbar'	0.1685 ± 0.0081	0.1742 ± 0.0086
'BDbar'	−0.1762 ± 0.0057	−0.1726 ± 0.0059
'CDbar'	7.3 ± 1.4	6.9 ± 1.3

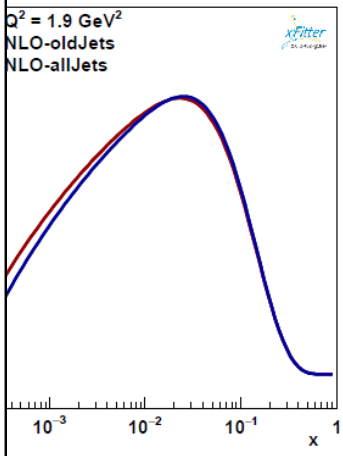


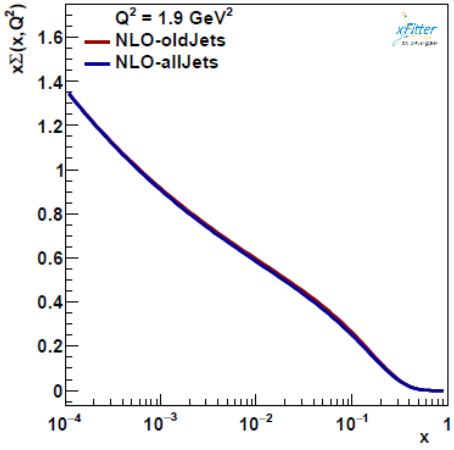


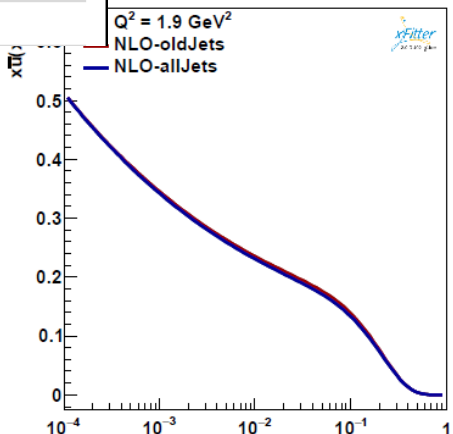
Parameter	NLO-oldJets	NLO-allJets
'Bg'	−0.02 ± 0.17	−0.04 ± 0.14
'Cg'	7.89 ± 0.78	7.92 ± 0.71
'Aprig'	0.79 ± 0.81	0.97 ± 0.62
'Bprig'	−0.191 ± 0.068	−0.193 ± 0.063
'Cprig'	25.00	25.00
'Buv'	0.719 ± 0.035	0.733 ± 0.032
'Cuv'	4.817 ± 0.087	4.792 ± 0.086
'Euv'	12.7 ± 2.1	11.7 ± 1.8
'Bdv'	0.873 ± 0.097	0.910 ± 0.093
'Cdv'	4.35 ± 0.41	4.54 ± 0.39
'CUbar'	7.42 ± 0.86	7.34 ± 0.91
'DUbar'	9.4 ± 2.7	9.0 ± 2.6
'ADbar'	0.174 ± 0.011	0.1685 ± 0.0094
'BDbar'	−0.1726 ± 0.0074	−0.1762 ± 0.0066
'CDbar'	6.9 ± 1.8	7.3 ± 1.8

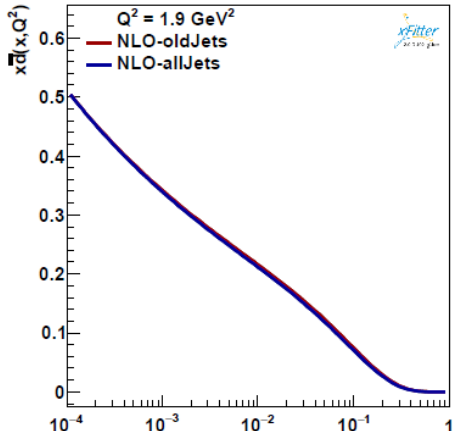








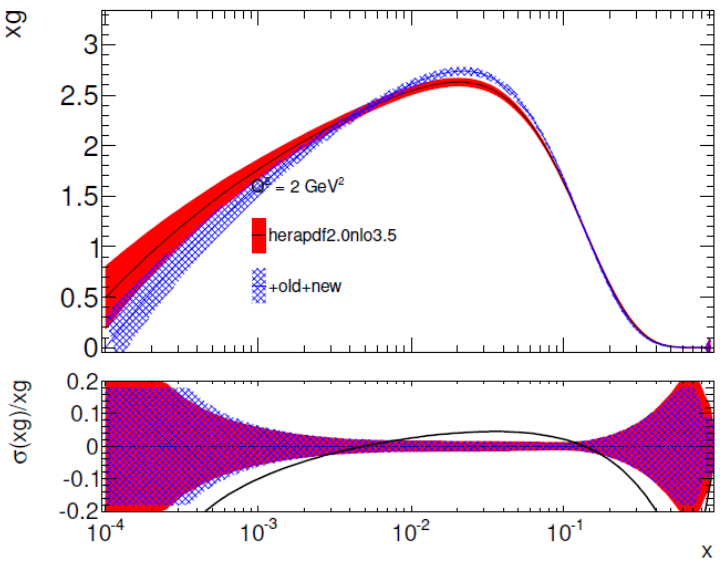


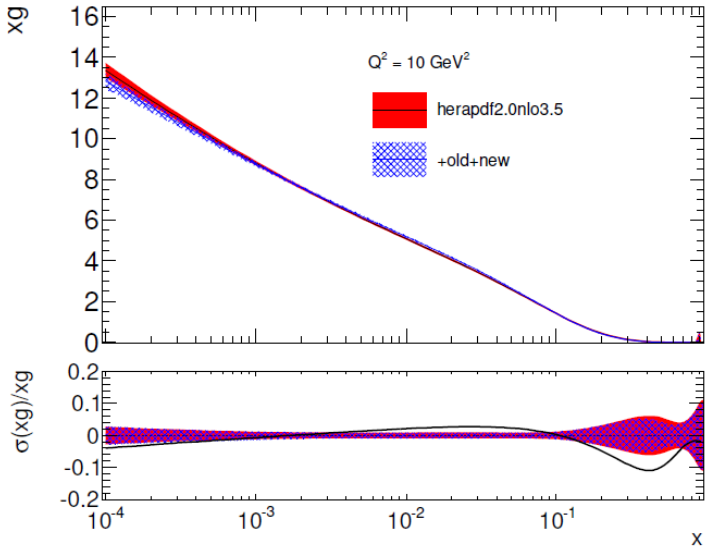


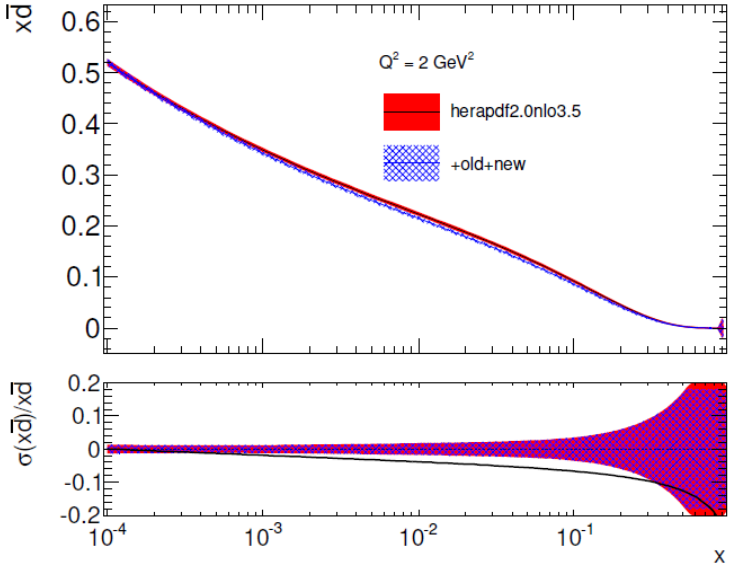
Now answer **WHAT do new jets do?** Consider this at NLO and at NNLO

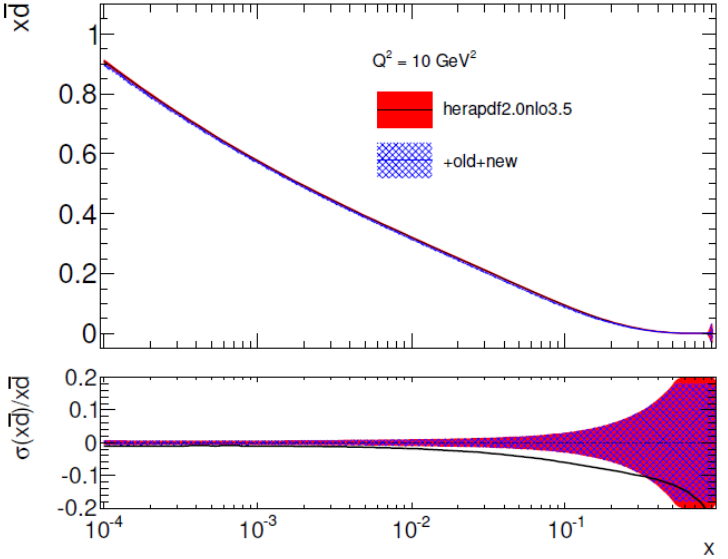
What do new jets do at NLO ?

The answer is not a lot when alphas is fixed









Parameter	NNLO-all	NNLO-old
'Bg'	−0.071 ± 0.045	−0.076 ± 0.044
'Cg'	5.72 ± 0.50	5.48 ± 0.50
'Aprig'	0.152 ± 0.042	0.142 ± 0.040
'Bprig'	−0.395 ± 0.030	−0.402 ± 0.030
'Cprig'	25.00	25.00
'Buv'	0.810 ± 0.030	0.811 ± 0.029
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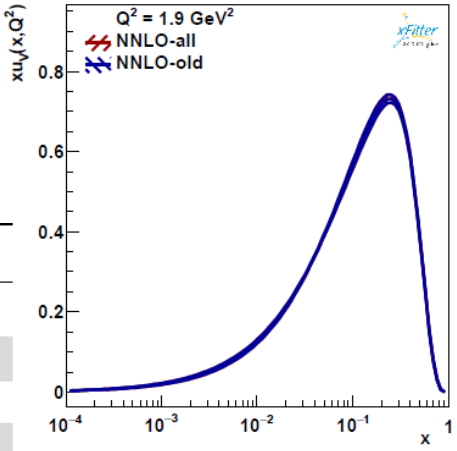
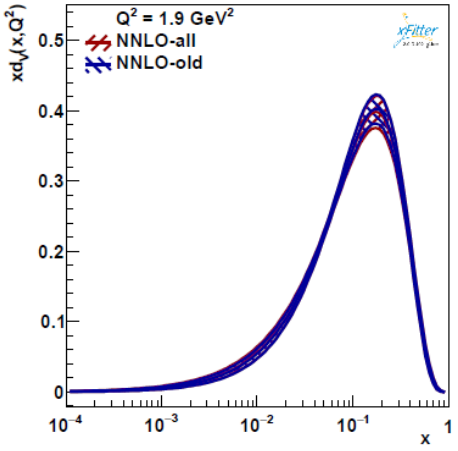
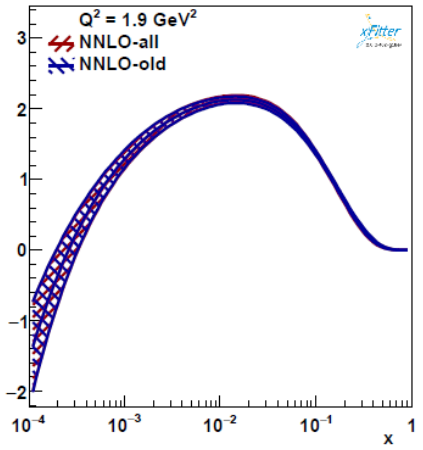
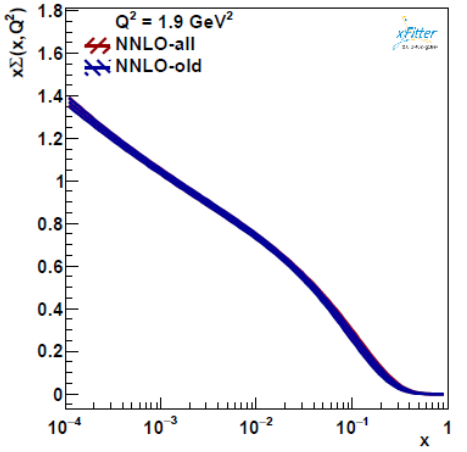
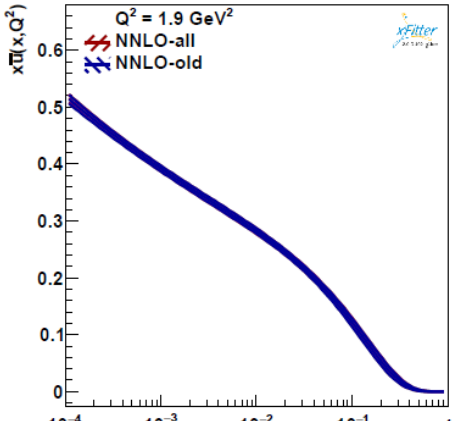
'Cdv'	4.59 ± 0.41	4.67 ± 0.39
'CUbar'	7.3 ± 1.3	7.2 ± 1.3
'DUbar'	1.7 ± 1.6	1.4 ± 1.5
'ADbar'	0.285 ± 0.012	0.287 ± 0.012
'BDbar'	−0.1211 ± 0.0052	−0.1200 ± 0.0052
'CDbar'	8.2 ± 1.5	8.8 ± 1.5

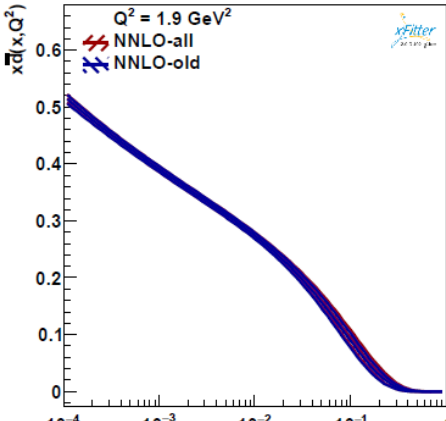












Parameter	NNLO-allJets	NNLO-oldJets
'Bg'	−0.071 ± 0.045	−0.076 ± 0.044
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'Bprig'	−0.395 ± 0.030	−0.402 ± 0.030
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'CUbar'	7.3 ± 1.3	7.2 ± 1.3
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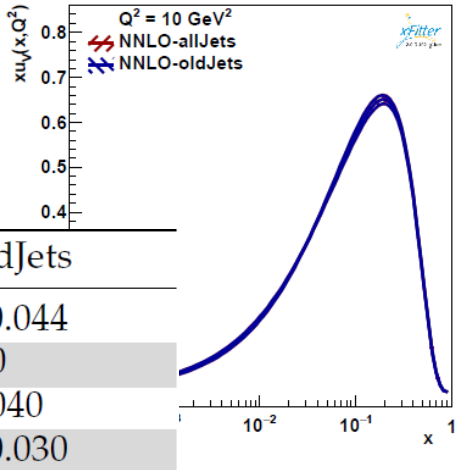
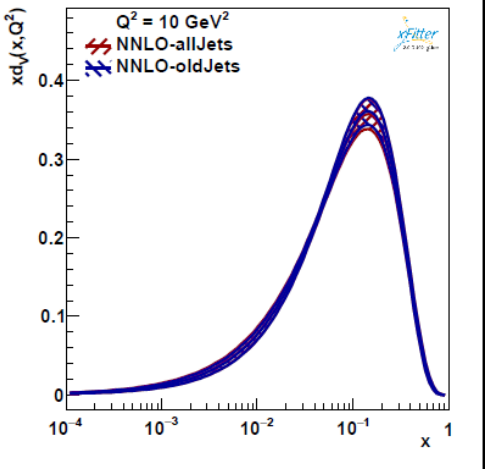
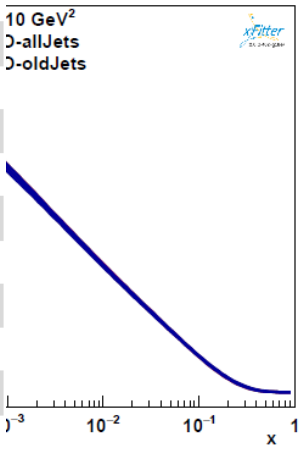
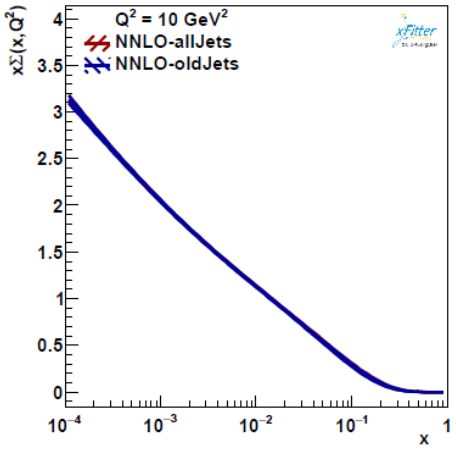
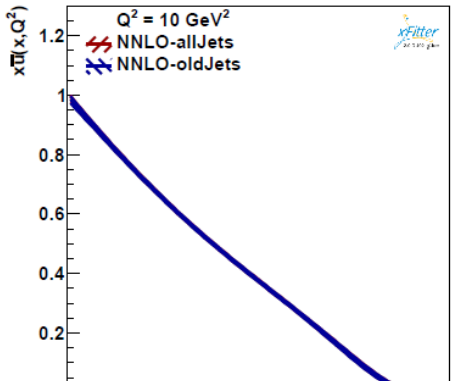
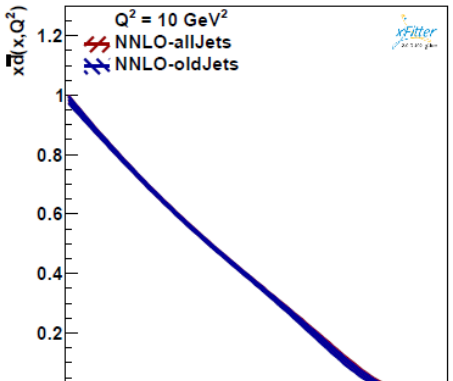








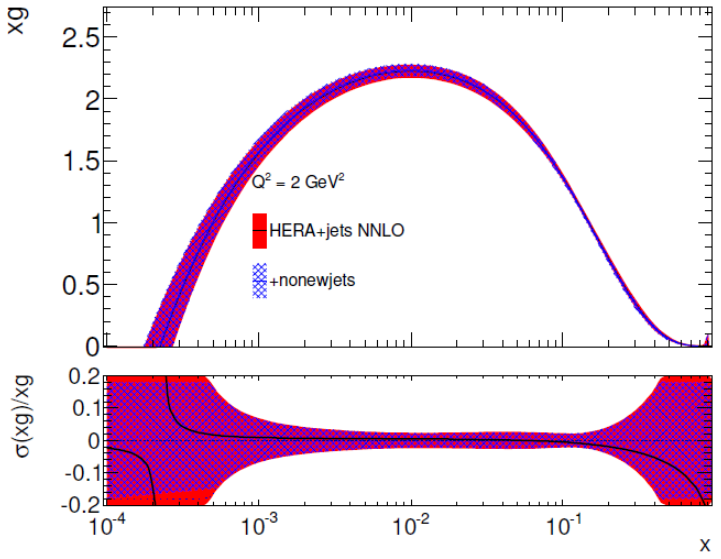


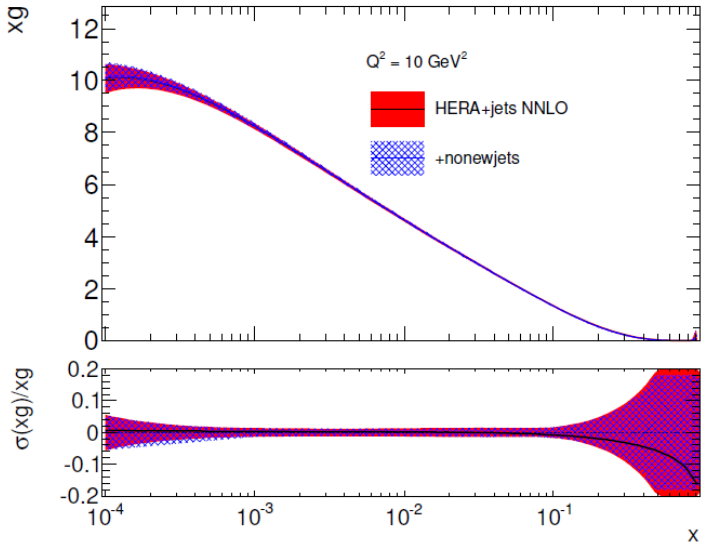


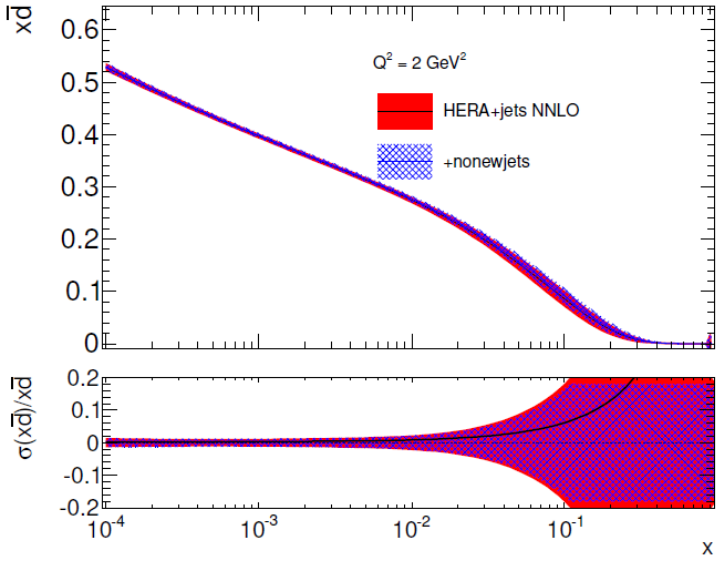
Now answer **WHAT do new jets do?** at NLO and at NNLO

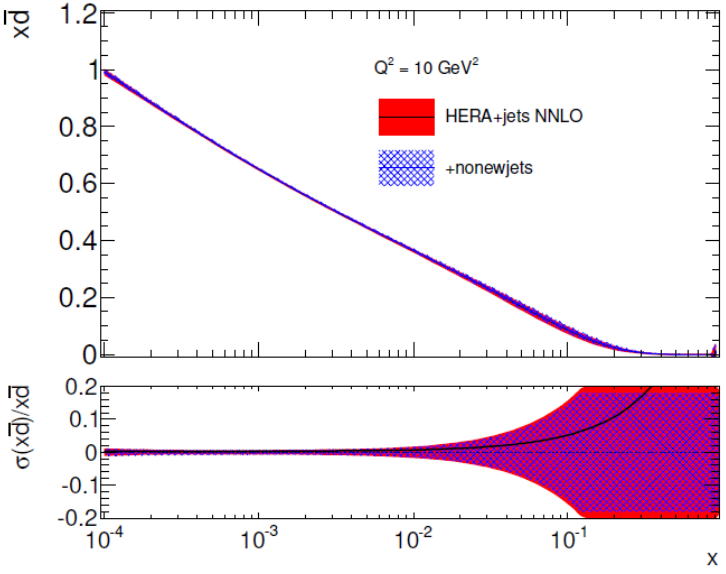
What do new jets do at NNLO

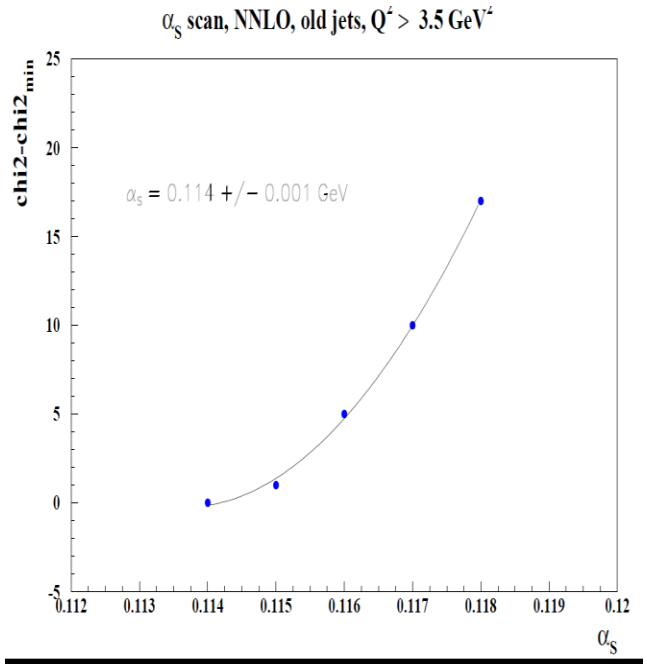
The answer is not a lot when alphas is fixed

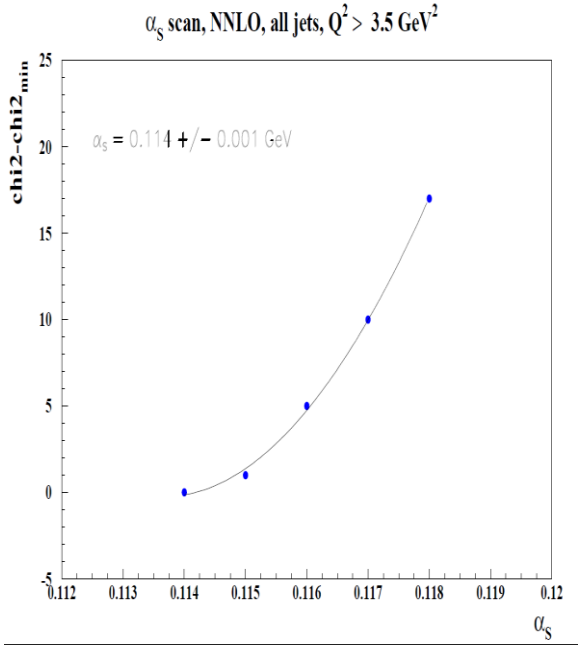









α_S scan, NNLO, old jets, $Q^2 > 3.5\ GeV^2$
chi2-chi2$_{min}$
α_S = 0.114 +/− 0.001 GeV
25
20
15
10
5
0
-5
0.112
0.113
0.114
0.115
0.116
0.117
0.118
0.119
0.12
α_S


α_S scan, NNLO, all jets, $Q^2 > 3.5\ GeV^2$
chi2-chi2$_{min}$
α_S = 0.114 +/− 0.001 GeV
25
20
15
10
5
0
-5
0.112
0.113
0.114
0.115
0.116
0.117
0.118
0.119
0.12
α_S